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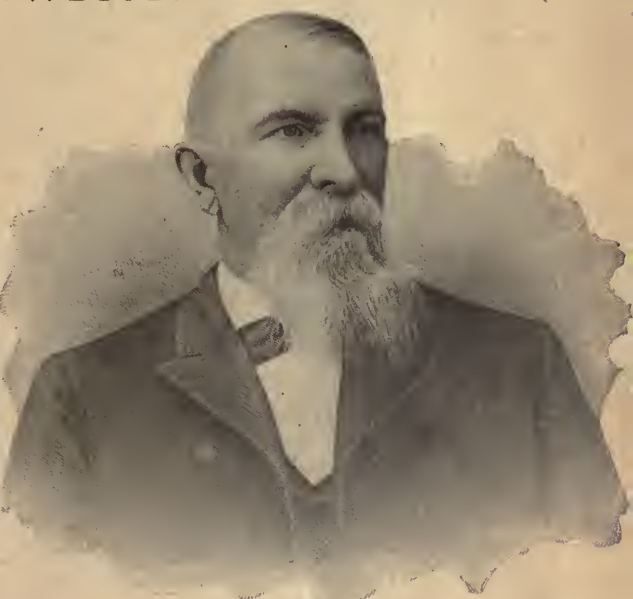
THE IRRIGATION AGE.

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THE PROGRESS OF WESTERN AMERICA.

HERE we are at the threshold of another new year. A year should mean very much to the men and women in the western half of the United States. For progress is the very essence of our large western life, and each year should be made to count for a great deal in the onward march. A year means fifty-two weeks of opportunity. And no week should close without some record of worthy achievement. There is a vast deal to be done. It must be done first for the benefit of each individual fireside. To surround that fireside with new comforts and to kindle there new aspirations, should be the first aim of the new year. But beyond the individual prosperity—inseparable alike from happiness and from usefulness—are other considerations that appeal eloquently to western hearts. The men and women who are working out the destinies of the great half continent between the Missouri river and the Western sea are laying foundations on which great structures will be built in the early future. The present readers of THE IRRIGATION AGE will not live to see the full fruition of the forces they set in motion, but humanity will live to see it and THE IRRIGATION AGE will live to record it. To be able to build for the future is a noble opportunity for a man or a people. This opportunity is the priceless possession of the citizens of Arid America. How have they used it during the past year? How will they use it during the next twelve months? These are natural topics for discussion in this department this month. The answer will be divided into three parts. The first deals with what has been accomplished in the way of extending irrigation works and settling lands. These matters relate directly to irrigation as an industry. The second division will sketch the growth of irrigation thought and organization. The third will attempt to foreshadow the developments of 1895.



HON. NELSON STORY.

A Prominent Candidate for the United States Senate from Montana.

Pioneer Irrigator of the Gallatin Valley.

I.—THE YEAR IN THE IRRIGATION INDUSTRY.

Stagnation and Progress.

The history of the past year presents two striking contradictions. In the matter of new construction it has been a year of stagnation. But the record of the year is luminous in progress along intellectual lines and in the growth of favorable public opinion. This should be a matter of supreme satisfaction to the true friends of irrigation. The year in which God *made* the North American continent is unimportant. The world dozes while the theologian and the geologist engage each other in bootless battles on this issue. But the year in which Columbus *discovered* the North American continent

is celebrated in song and in story, commemorated in marble, in granite and in bronze, and lived over again in world's expositions, in which all mankind participates. Building canals will not make public sentiment, but making public sentiment will build canals. It is therefore no cause for discouragement to learn, after a careful survey of the field, that very little important construction has been accomplished during the past year, and that there is not much actually in hand for the coming year. Nevertheless, many interesting things have happened in connection with the irrigation industry on its physical side.

Arizona and New Mexico.

Arizona, California and New Mexico comprise what is popularly known as the Southwest. Arizona is a very hopeful region. During 1894 the important system known as the Consolidated, on the south side of the Salt river, not far from Phœnix, has been largely extended by the use of a massive dredger, which attracted wide attention in construction and engineering circles. Some new work has been done in connection with projected canal systems from the Rio Verde and the Agua Fria, which are also in the neighborhood of Phœnix. The large dam belonging to the Gila Bend system, commonly known as the Peoria canal, has been rebuilt. Much preliminary planning has been indulged in concerning projects about Tucson and Yuma. There is no question but that results will follow in good time. The Casa Grande system at Florence has been perfected by the completion of dams and canal. But the most important item of the year's progress in Arizona is the construction and practical completion of the railroad from Prescott to Phœnix. This will furnish at a very early day a northern outlet for the products of the wonderful Salt River Valley. The result is certain to be a very marked impulse in the growth of population. Arizona is very little known to the country and the world. The new railroad will be a part of the Santa Fé system, which is very active and enterprising in exploiting its territory. This system covers a wide stretch of unprofitable country in the arid West, and, now that it has reached a valley that has something to be seen and something to be developed, the Santa Fé people may be depended upon to inaugurate very effective plans for the benefit of Arizona. It has been a dull year in New Mexico. The great works on the Rio Pecos were practically completed in 1893, but one large reservoir, which had been destroyed by a cloudburst, was rebuilt during the past year. The extension of the Pecos Valley railroad from Eddy to Roswell was a notable achievement in the midst of financial panic. The completion of this work foreshadows a further extension to connect with some railroad to the North. Settlement has progressed somewhat along the Pecos during the year. The only other progress to be noted in New Mexico is the building of a dam and canals, to water about ten thousand acres on the Armendaris Grant, the property of Mr. Wilson Waddinghan, near San Marcial. The event of highest importance to New Mexico was its success in securing the Fourth National Irrigation Congress for Albuquerque, September 15th next.

Interesting Events in California.

It has been a year without important construction, but not without interesting events, in California, the foremost of the irrigation States. The failure of the Bear Valley company came with the close of 1893 and had a depressing effect upon all enterprise on the Coast. There seems to be a good prospect that the Bear Valley works will be in the hands of a new company of abundant means early this year. If so, the new dam will be built and the distributary system extended to cover the Alessandro and Perris irrigation districts completely. The Arrowhead system has made some progress during the year. Many important undertakings have been projected throughout California, but the year's interest centers in colonial development. The most notable successes in this line were those of Lake View and Antelope Valley. The irrepressible Frank E. Brown originated the Lake View project and organized excursions of home-seekers with extraordinary success. But he came to grief as the result of reckless management. He was forced out of the control by a Pasadena syndicate which took up his work and carried it forward several stages. Mr. Brown demonstrated, however, that it is possible to organize colonies of the best class when the matter is undertaken with sufficient energy and ability. The same truth was illustrated in the almond colonies of the Antelope Valley by an enterprising Chicago firm. The unique development of the year in California was the colony organized by Editor Wilson of *Farm, Field, and Fireside*. No colony plan was ever exploited with more tact and ability than this one, and none was ever carried more quickly to success, so far as the selling of land was concerned. But Editor Wilson is a better writer than engineer. His adjectives are considerably more abundant than his water supply. It is sincerely to be hoped that water will be found for the lands so promptly purchased by the readers of the Chicago agricultural journal over which Editor Wilson presides. There are so many places in the West which are well watered that it seems a great pity to have such rare energy and notable success squandered in a district where any element is doubtful. The most widely-discussed development of the year in California related to the "purchase" of the Crocker-Huffman canals and lands in Merced county. This dramatic episode has worn many phases at different times. One of the



HON. JOHN E. JONES,
Of Nevada.

most interesting was the trip of a party of labor leaders from Chicago with the purpose of founding a coöperative colony. As yet nothing substantial appears to have come from the movement. The Merced properties are among the most valuable in California, and the Chicago gentlemen associated with the matter are of the highest repute in financial circles. It is to be hoped that they will go forward with the development of the property by dividing it into small farms and encouraging diversified production. The colonies in Kern Delta have enjoyed a healthy growth during the year and many important developments are in hand for the early future. Electricity will be a feature of these developments, and this will possibly be the field of the most advanced colonies in the arid regions.

Colonies in Utah and Idaho. There is less to note in the Intermountain West. The most progressive efforts in this region were those under the Bear River system of Northern Utah. The construction of these works was the boldest feat ever undertaken in the interest of irrigation in this country outside of California. They were completed about three years since, but no very energetic effort at development was made until the administration passed into the hands of William H. Rowe, a year and a half since. Mr. Rowe inaugurated a vigorous colonization policy, now at its height. He is bringing to bear upon the problems of this company the rich experience of the Mormon people and seems likely to repeat their marvelous success in the development of prosperous industries. In Idaho the Snake River country, around Idaho Falls, has witnessed a remarkable colonization movement at the hands of Scandinavians. The movement from the old Northwest to the eighty-acre farms of the Snake River country promises to effect far-reaching changes. In Western Colorado there has been a steady extension of the fruit industry, and the peach display at Grand Junction in September produced an unusual impression on the public mind. More has been accomplished in colonization in Wyoming also than usual. The lands of the Development company at Granger have attracted many new settlers and the movement is promising. A good many people have been attracted from Kansas and Nebraska to the San Luis valley.

A Glance at Two Extremities. There has been a marked revival in irrigation interest along the northern railroad lines, in Montana and Washington. The construction of the Burlington railroad into the Yellowstone valley, with its terminus at Billings, has had a favorable effect in attracting settlers. In Eastern Washington some small constructions have been carried on and there has been a slow, but promising, growth of population. Oregon has nothing to show for the year's work under this head. Passing now from the Pacific Northwest to the Great Plains region east of the Rocky Mountains, we find that perhaps more has been expended for construction and surveys in Nebraska than in any other portion of this region. The Kearney power canal has been widened and deepened with a view to the use of water for irrigation in a locality where it has hitherto been regarded as libelous to say that irrigation was necessary or desirable. A good deal of work has been done in Northern Nebraska on the Niobrara river, and something in the Southwest, on the Republican and the Frenchman. In Kansas there has been a marked growth in the matter of small individual plants. This is also true in Texas. This is the meager record which the year has to show for the irrigation industry proper. It is doubtful if a million dollars have been expended for new works. But this is not in the least remarkable. It has been a period of stagnation in investment everywhere. Colonization has looked up decidedly, but it is only the spray of the rising tide. As has already been intimated, the real satisfaction of the year is to be found in another quarter.

II.—THE YEAR IN IRRIGATION THOUGHT.

The Break of Day. The popular convention is the nursery of the American Idea. The newspapers and magazines are the thermometers which mark its rising temperature. And the Congress of the United States is the final arena in which

the Idea achieves its substantial victories. It is, then, in the conventions, public prints and record of congressional enactments, that we must study the progress of irrigation thought during 1894. We have already seen that the year was not notable for its record of construction or colonization, although in the latter respect it was somewhat encouraging. The progress of ideas cannot be measured by physical standards. Great movements, like great men, go through a long and painful process of preliminary development and then stand out suddenly and distinctly before the public eye, dominating the thought and imagination of the country and possibly the world. There are three indispensable conditions of a successful propaganda, whether in industry, politics, or religion. They are, first, a just cause; second, good leadership; third, an opportunity. Starting with a cause of tremendous significance, physically based on half a continent and deeply planted intellectually in human need, irrigation has latterly developed good leaders in every State and county. As for the opportunity, there can be no question that it is here. It is not yet as marked as it will be, but the dawn is in sight and noonday will come. Only the few who have had a chance to study the subject from all sides, in every part of the country and among all classes of people, realize how near we are to full daylight, nor what large things will finally stand revealed to the world's view.

Semi-Arid Region Converted. The popular convention has done its best work during the past year in the semi-arid region, and Kansas has been the hotbed of its operations. In the picturesque language of Judge J. S. Emery, "Kansas has got her head and tail up, and irrigation is a go." It would puzzle the historian to calculate just how many meetings have been held in Kansas, but they have been very numerous indeed. They have resulted in arousing an immense popular interest. The culmination was reached in the State convention held at Hutchinson, November 23d and 24th. This was attended by delegates from all parts of the State, including many members-elect of the new legislature. It was addressed by almost as many prominent men as are usually drawn together by a national convention. The attendance on the evening of the 23d exceeded three thousand people, and perhaps this was the largest number ever assembled to listen to the discussion of irrigation. Conventions were also generally held throughout Nebraska. Those at Omaha in March, and at Kearney two weeks ago, were especially notable. On all these occasions attention was chiefly centered on the practical aspects of irrigation. The question of water supplies, pumping plants and methods of cultivation superseded all others. The leaders of the movement in the semi-arid region have shown that they are blessed with a rare power of organization. They have pursued the plans which seem likely to lead most surely and quickly to results. Already, the irrigation idea has taken firm hold upon Kansas and Nebraska and far-reaching changes will be brought about in the industrial life, and ultimately in the intellectual life, of those States. There is equal need of the same sort of agitation in the Dakotas, Oklahoma and Texas. In those localities something has been done during the past year, but much more remains to be done. The conversion of the semi-arid region is important because it will solve the question of prosperity for a vast expanse of country which has hitherto suffered from the drouth, injuring the reputation of the States and wrecking investments, but, what is far more important, entailing hardship and wretchedness upon thousands of men, women and children.

Influence of the Commissions. We have given the dramatic movement in the semi-arid region the first place in this record as a matter of justice to the brave spirits who have so successfully led it forward. It is not, however, the part of the year's developments which will exert the greatest influence in shaping the future. It does not touch any of the larger questions involved in the reclamation and settlement of the arid empire. It deals not so much with the making of homes for future millions as with the sustenance of present thousands. The richest contribution to the progress of irrigation thought for 1894 was the work of the State Commissions. These have not been fully appreciated, a fact much to be regretted. Nevertheless, they are a contribution of inestimable value to the common fund of knowledge and to the intellectual current of the arid region. In THE IRRIGATION AGE for October these reports were quite fully reviewed. It should be remembered that most of them were based on letters written in answer to questions sent broadcast through the several States. They represent, therefore, the views of a wide public on the larger questions involved in the work of conquering the arid region. They have already begun to exert a quiet influence which is destined to grow with the years. In so far as the National Irrigation Congress took any forward steps they were taken as the direct result of the work of the commissions,

Significance of the Utah Revival. Another and most interesting phase of the year's progress is the revival of interest in Utah. The world is constantly referred to this territory as the classic land of American irrigation. Hence it seems a little strange to talk about an irrigation revival there. Nevertheless, there was much need of it. Utah is in the very heart of the mining region. Public opinion has seen nothing worth talking about except silver. One prominent journal has even gone so far as to say that a great civilization has never rested on agriculture, but al-

ways on mines. The revival of irrigation interest in Utah is an evidence of sanity. There is no question but what mining is an important industry in Utah. Neither is there any question but what agriculture is a far more important one. Mining makes a *few* people rich. They generally spend their riches a long distance from the place where they acquired them. Agriculture makes *many* prosperous. These many are married to the soil. It is *their* soil, and they love it. Now, the revival in Utah means that public opinion in that locality is recognizing irrigation as the basis of its present, and the hope of its future, greatness. The large delegation sent to the congress at Denver was one evidence of the revival, and the wide circulation of literature in the interests of getting capital and settlers is another. It was a most pleasing thing to behold the Utah delegation at the Trans-Mississippi Congress at St. Louis proudly distributing a large and beautiful pamphlet describing the glories of their soil and climate, of their industrial and social institutions, erected on the broad foundation of irrigation. The significance of this fact is that the people of the mountain States are beginning to appreciate what a tremendous advantage they have in being able to make homes for the millions. If other States will follow Utah perhaps it will turn out that the transcendent gain for irrigation thought in 1894 was this revival. There is some excuse for the eastern man who is indifferent about irrigation, but absolutely none for the western man who is equally so.

The Growth of Popular Interest.

Now to apply the thermometer which measures the rising temperature. The Third National Irrigation Congress, held at Denver in September, attracted wider attention than any previous event of the kind. Among the newspapers which discussed its proceedings were the *Chicago Tribune*, *New York Tribune*, *Philadelphia Ledger*, *Boston Transcript*, *San Francisco Bulletin*, *Chicago Inter-Ocean*, *Minneapolis Tribune*, *St. Paul Dispatch*, *Philadelphia Inquirer*, *Chicago Times*, *Indianapolis Journal*, and other newspapers which have never paid much attention to the movement in the past. Besides this, elaborate articles have been published during the past year in the *New York World*, *Chicago Tribune*, *Chicago Record*, and *Chicago Inter-Ocean*. There has also been a marked degree of attention on the part of southern newspapers. This has resulted in a call for a Southern Irrigation Congress, to be held at Atlanta during the first week of October, 1895. Another significant and encouraging feature of the year was the attention given the matter by *Public Opinion*, the Washington newspaper which is conceded to be an accurate reflection of the national mind. Among eastern magazines the *Review of Reviews* has been most generous and constant in its friendship for the cause of irrigation. On the whole, the development of newspaper interest in irrigation has been remarkable during the past year, but it is much to be doubted whether the newspapers have kept pace with the growth of interest on the part of the public.

First Victory in Legislation.

Irrigation thought has certainly made marvelous progress during the past year. Much has been gained, both in the East and West, in the matter of impressing the popular imagination. So far as legislation is concerned, it is only when public men are converted that real progress is accomplished. Has the year been effective in this quarter? Unquestionably it has. Irrigation has appealed successfully to the mind of at least one prominent public man, and a Presidential candidate at that. Hon. Thomas B. Reed's eloquent reference to the subject in his speech at Pittsburgh last April was reproduced in these pages at the time. This is very encouraging, when the political importance and geographical location of this distinguished gentleman are considered, but there is also a substantial legislative triumph to be recorded. This is the passage of the Carey law, which encountered only nine dissenting votes in the House and none whatever in the Senate. The discussion of this measure brought out several good speeches in the House, and for the first time irrigation was the subject of attention on the floors of Congress. This is practically the first recognition irrigation has had, and it is therefore a very important feature in the record of a year which has been triumphant in the matter of progress along intellectual lines. The Carey law unmistakably foreshadows the character of the coming national policy. The nation will rigidly guard the people's heritage. It will not make appropriations. It will permit the States large powers of administration, to be exercised under stringent conditions. The function of the States will be ministerial. The Federal Congress will make the laws governing the disposal of the public lands, but western men will be left to carry out the work in all its details.

III.—THE PROGRESS OF 1895 FORESHADOWED.

Now for the Legislatures.

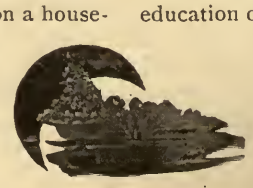
Looking forward to the events of the new year, we confidently predict that the record of 1894 will be very far surpassed. Great movements do not pause and falter when once fairly started. On the contrary, there always comes a time when they burst their narrow barriers and sweep all before them, like a torrential stream in flood season. That moment will surely come for irrigation. It may be very near at hand. It may be that a few years yet intervene, but in the meantime progress must be constant and larger year by year. The first important event in 1895 will be the assembling of the legislatures of Colorado, Wyoming,

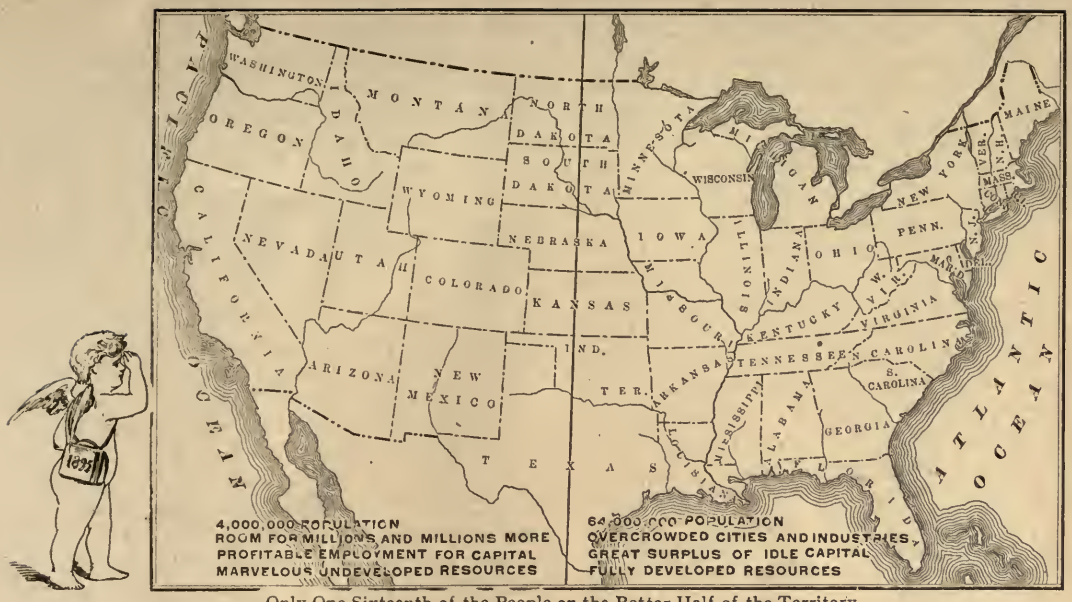
Idaho, Nevada, California, Washington, Oregon and Montana. The friends of irrigation are up and doing in all these States. The National Committee is in close touch with all the incoming governors. A great effort will be made to secure the enactment of legislation which will enable the States to realize the benefits of the Carey law. It is probable that no attempt at purely public enterprise will be made, but that State boards will be created with power to select lands for reclamation and enter into contracts with construction companies, the land being sold for a nominal sum or given away, and the State fixing the maximum price of the water rights. Under this plan one million acres in each of the States mentioned could speedily be thrown open as fields where industrious men might find labor and homes. The outworking of this program may possibly lead to stupendous results during 1895. If it does not do that, it will at least put eight States in a position to develop rapidly hereafter. Kansas and Nebraska will also make determined efforts to provide themselves with administrative systems.

Advanced Colonies Coming. It may also be predicted with confidence that another early development of the year will be the founding of important colonies which are calculated to exert a far-reaching influence upon the future of Arid America. The only salvation for companies which have large investments in irrigation works is to colonize their lands. The operations of the Carey law will put a large amount of cheap land upon the market. This will not injure the irrigation companies, but it will cause them to change their methods. They must give more thought to the matter of planning colonies which will be attractive to the people. They must help their settlers to find the way to prosperity. There will be just as many kinds of land in the market as there are qualities of dress goods in the dry goods stores. Some people will buy calico, some will buy cheap woolens, some will buy fine silks. But those who buy the silks will expect to find competent dressmakers at hand, and they will be very particular about the style and fit. The production of silk is not ruined by the presence of calico and woolen in the market. The lands already acquired under private enterprise are generally those which offer the best advantages. If those who have them in hand will add to these advantages carefully-matured plans for attractive colonies, they will find that the reclamation of the public lands will be a great advantage to them. It will result in making irrigation a household word, and turning the thoughts of millions of people to the possibilities of home-making in the arid region. And when this is done, the best irrigated lands will be in high demand by those who have means to take advantage of their opportunities. It yet remains to make a colony which shall represent the best modern thought, and the highest social and industrial conditions possible under irrigation. But we believe this will be done during the coming year.

The Campaign of Education. Another certain development of the new year will be a campaign of education in the East, and, possibly, in Europe. This seems likely to be reinforced by a considerable output of popular literature. The chairman of the National Irrigation Committee established modest headquarters in New York City during the fall, and has set in motion a number of projects looking to the inauguration of a vigorous campaign in the interest of western progress. It is a little early to predict results. And yet there is much ground for encouragement. It is, perhaps, not hazardous to predict that a good deal will be done this year in the way of popularizing the irrigation cause. There will be many addresses to general audiences, to labor unions, to banking and commercial associations and to other bodies. Not much could be achieved without the assistance of influential public men, newspapers and magazines. But it is hoped that these forces may be enlisted. If they are, it is within the range of possibilities that the making of history will be begun in earnest.

Chicago, New York, London. Another important undertaking easily within the reach of the men of Arid America, ought to be accomplished this year. Irrigation should have an attractive headquarters in Chicago, in New York, and in London. In each of these great cities there should be a permanent exhibit of the products of irrigation, as well as something to show the geography of the arid region and its varied resources. There should be an abundance of maps, models and photographs. There should be also a complete collection of Western newspapers, and a very abundant supply of attractive illustrated literature for distribution. No single interest can afford to maintain such headquarters, but a combination of interests could do it on a magnificent scale with corresponding results. We may have something further to suggest on this subject, for we most earnestly desire to see it undertaken during the present year. It would be a mighty engine for the education of the public.





Only One-Sixteenth of the People on the Better Half of the Territory.

WHY TIMES ARE OUT OF JOINT.

HOW THE SITUATION WOULD LOOK TO 1895 IF HE WERE HUMAN.

BY THE CHAIRMAN OF THE NATIONAL IRRIGATION COMMITTEE.

WHAT is the matter with this great country?

It enjoyed very many years of sturdy health. Then why the wild and feverish pulse of 1893, succeeded by the weak, uncertain pulse of 1894? Why the widespread business ruin in the midst of the Columbian celebrations of two summers since, followed by idle factories, by armies of marching tramps, by swarms of beggars in great cities? Why is money quoted at two per cent. in New York, and sometimes loaned on good security in London for less than one per cent.? What is the meaning of political landslides, first to the South pole of Democracy, then to the North pole of Republicanism, and both within the space of twenty-four months? What does it mean when John Burns solemnly avers that he beheld more misery and wretchedness in New York and Chicago in a single week than he ever saw in London during his lifetime? Why is the national debt increasing at the rate of one hundred millions per year? What has become of the prosperity which was scheduled to arrive the day the Sherman silver law was repealed? Where is that other era of peace and good will which was to dawn when Congress ceased to tinker the tariff?

These are questions which strike close to every hearth-stone. They are interesting not simply to political economists and social philosophers. They disturb the slumbers of the railway president, and fill the bricklayer with apprehension.

IF 1895 WERE A HUMAN BEING!

These are the conditions which greet the advent of the new year. If 1895 were a flesh-and-blood human being, as he is often represented to be by the comic artists, and if he were asked to study the situation without previous knowledge or prejudice, what would he see? Remember, he is just born. He is neither Democrat, Republican nor Populist, neither free-trader nor protectionist, neither gold bug nor silver monomaniac, neither radical nor conservative, neither capitalist nor pauper. He is just a fresh intelligence from another planet, with no human entanglements whatever. All he knows is what he sees. The average human vision is colored by its environment, education and prejudice. This new personage, whom we are creating in order that we may have the privilege of looking at our country through his free eyes, has none of these disadvantages.

OUR IMPERIAL DOMAIN.

The first thing that would strike young 1895 dumb with amazement would be the magnificent dimensions of the United States. Texas alone is larger than either the Austrian or German empires, larger than France, larger than Spain, larger than Sweden. California and Montana are each larger than Turkey or Norway. New Mexico is larger than Great Britain and Ireland, and larger than Italy. Even the little States of New York and Pennsylvania are each larger than

Ireland, or Scotland, or the Netherlands, or Greece. And the forty-four States and three Territories combined present the grandest field for the triumphs of civilization on the globe. The new year would certainly be surprised to learn that a nation with such assets at its back could be in a state of financial, industrial, social and political embarrassment.

SOME VERY STRIKING ANOMALIES.

But after 1895 had comprehended the territorial grandeur of the United States, he would be struck dumb again by certain very curious anomalies which would stand out with startling distinctness to his unprejudiced vision. He would observe that almost everybody lives in the eastern half of the continent. If he consulted the census he would find to his amazement that more than ninety per cent. of the American people live east of the Missouri river. He would find not only that the swarming millions are in the East, but that here also is a vast amount of idle capital and a growing and threatening amount of idle labor. He would not have to be told that idle capital and idle labor are useless. Nor would he need to be gifted with extraordinary intelligence to understand that whatever is idle, and therefore useless, is also dangerous.

Now, it would not be at all difficult for this newcomer to discover why capital and labor are loafers, and almost beggars, in America at this time. Remember, 1895 is no statesman, like Secretary Morton, and no eminent statistician, like Mr. Edward Atkinson of Boston. So it would not occur to him to join the former in declaring that the country is in trouble because it is "overproducing" the necessities of life, nor to follow the latter in formulating remedies in the shape of pamphlets designed to show these overfed Americans how they can exist on soup bones for a few cents a day. You see, 1895 is not trying to use his brains, but only his eyes. And he will instantly observe that the reason capital and labor are not engaged in developing new resources in the eastern part of the United States is that there are practically no new resources to develop. And this would lead our unprejudiced observer from the upper skies to turn his gaze toward the other half of the continent. There he would see a domain of equal dimensions with a population amounting to only about seven per cent. of the country's total. He would observe that here is as much hunger for capital as there is a surfeit of it in the East. But the most astounding thing that he would realize would be the fact that in western America the good God made resources many times as varied and extensive as those in Eastern America. These startling anomalies would tell young 1895 the reason for national distress and stagnation in much less time than it has taken to write these words. And if the whole American people could be gathered into a gigantic balloon, lifted miles above the mists of all provincial and political prejudice, and permitted to take a bird's eye view of their country for a few minutes, they would see it all with equal clearness.

THE LESSON OF THE WORLD'S FAIR.

In 1893 the American people expended millions of dollars and unmeasured oceans of patriotic oratory in celebrating. Celebrating what? The triumph of a political system? The triumph of protection over free trade? The triumph of bimetalism over the single standard, or the triumph of the single standard over bimetalism? Not at all. These were but incidents in the fabric of national achievement. The World's Exposition celebrated the conquest of human genius over the continent discovered by Columbus. In this conquest industry and art, labor and capital, intellect and simple brawn, all had their honorable parts. But the great material fact was this: That a continent had been reclaimed from savagery. Forest and prairie, lake and river, mountain and valley, had been turned to the manifold uses of humanity. All that the World's Fair represented was the product of labor applied to a continental item of raw material. In the process of converting it into the manufactured article which we call civilization, a vast prosperity was yielded up and distributed through all ranks of society. It was the triumph of this process that the World's Fair celebrated with loud acclaim.

ON WITH NATIONAL DESTINY!

National life resembles water. When it stands stagnant it gives forth a stench that breeds disease. It is only pure and sweet and health-giving when it flows swiftly. And it is still pure if in the course of its rapid flow it encounters rocks and sandbars. Difficulties and dangers are not necessarily evils, but motion and progress—these are indispensable. Prosperity will come back to the American people when they return to the policy that made them great. We are to-day in the process of readjustment. Industry and society will be reorganized to some extent. Certain tendencies of our later development have gone too far and must be arrested. But these things will work themselves out all in good time. The thing of vital importance is that the nation should go forward in its destiny. The armies of civilization must not halt at the one hundredth meridian, the boundary of Arid America. They must go forward to new and grander conquests. They must make homes for new millions, erected upon new foundations, suited to the needs of a new century. *So long as one-half of this continent remains to be conquered there should not be an idle or homeless man in America or in Europe, nor a surplus and useless dollar.*

WESTERN INITIATIVE ESSENTIAL.

The responsibility for progress rests upon the men of the West. The initiative must come from them, though other sections, as well as other countries beyond seas, will largely furnish the capital and population required. Popular ignorance of the opportunity for conquest in the West is simply appalling. The average eastern man is nearly as incredulous as were King Ferdinand and his fool courtiers when Columbus first broached his project of discovery. Eastern people know more about the interior of Africa than about the greater and better half of their own country. Chicago is the frontier of their imagination. They think Chicago is "out West." If they know nothing of Greater America, beyond a vague conception that it exists somewhere, is it surprising that they know nothing of irrigation and have not the faintest shadow of a conception of its economic possibilities?

Now, there is nothing strange about the dense ignorance of the eastern mind. The blame is rather to be laid to western men. Those who have knowledge should enlighten those who have not. Provincialism is not a crime, but a misfortune. It should not be punished with abuse, but relieved with knowledge. The present year ought to witness important progress in this direction.

IRRIGATION ABOVE MINING.

There is one thing more amazing than eastern ignorance of irrigation. This is western indifference to it. The public opinion of States like Colorado, Idaho, Nevada, Utah and Montana, has limited its vision to the one question of silver coinage. On this subject these States are as mad as were Virginia and South Carolina about slavery forty years ago. We do not mean to intimate that their cause is not just, but we say it is insanity to think and talk and pray for nothing but free silver coinage. If that were the single string to the western bow it would be comprehensible. But it is not the single string. It is not even the best string. Irrigation is vastly more important. The mining of silver makes a few men rich and they give employment to a few thousand laborers in the intervals between strikes, lockouts and shutdowns. Occasionally the man who has acquired wealth in the mine puts up a fine building or residence in a western city. But usually he spends his money elsewhere. Nevada is a fair specimen of what mining, single-handed and alone, will do to make a great State. Utah, Southern California and certain portions of Colorado faintly suggest what the sovereignty of proprietorship, represented by thousands of small farms, will ultimately accomplish in making great States.

PUT YOUR OWN HOUSE IN ORDER.

The first thing for western men to do is to make their States ready for the coming millions. The foundation of society is law. That foundation must be greatly strengthened and extended to permit the growth of great social structures in the West. Every State should have an engineering department to study and exploit its irrigation possibilities and to administer its irrigation systems. It is monstrous to permit private individuals to use the streams without public supervision and control. It is a crime for a State to have no official knowledge of the resources on which its prosperity must rest for all time. And there is the Carey law. It gives each State one million acres to deal with. With an average farm unit of forty acres, and an average family of five persons, each State can make homes for 125,000 people under this law. The law now applies to eight States. It thus makes possible the creation of homes for 1,000,000 people on the farms alone. Probably as many more would find employment in towns and villages as the result of this movement. Will the several States wake up to the duty and the opportunity? It is for the legislatures of these eight States to answer. Their sessions are brief. The great work of raising capital and enlisting settlers must be done after the legislatures adjourn. But nothing is possible without legislation. This must be provided now, or not for two years. Two years is a long time when industry and society are in the peculiar condition of to-day. If the legislatures provide the foundation of law, public spirit will very likely erect a superstructure in the months to come.

A CAMPAIGN OF EDUCATION.

But while the West puts its house in order, a campaign of education must be inaugurated throughout the eastern States and ultimately in foreign countries. For this great work no capital is available, and yet it must and shall be done. How? By the same qualities of faith, pluck and unconquerable enthusiasm that have borne forward to victory every cause and idea which ever made history. This is our day of small things. This is the hour when individual sacrifice and effort can alone be arrayed against the difficulties that encumber the pathway. But we shall soon pass beyond this stage. As we go forward reenforcements will come from all quarters as they came to Sam Adams and to Lloyd Garrison when they led crusades for liberty. Our cause is as sacred as theirs. Sam Adams fought for political independence. We fight for industrial independence, which is even nearer to the common hearthstone. Garrison fought for liberty for black men. We fight for liberty for white men. Failure is impossible. If I am not much mistaken, the events of the next twelve months will begin to realize these hopes. But whether it be soon or late, the day will come when a mighty host will follow where the men of western America shall lead. And they will lead in making institutions which

will guarantee better forms of civilization than the world has ever known.

LOOKING FROM THE EAST.

These words are written in New York City. When I accepted for the second time the standard of leadership, so generously tendered by the representatives of twenty-three States at the Denver Congress, I promised that our countrymen should hear us and that they should listen. By an extended trip through the West and public addresses at leading points, and later by correspondence with incoming governors, members of the National Committee and other public men, I have sought to prepare the West for its part in coming events. I am now almost ready to open the battle in the East. I have presented our cause to many public men in Washington. I have waited upon Presidential candidates and urged them to hitch their wagons to the star of irrigation. I am now in conference with prominent journalists and other friends of progress in New York. It is not yet time to disclose the plan of campaign. But it is proper that the friends of irrigation should know that their work is not being neglected. Whatever may be accomplished by individual enthusiasm and slender personal resources will be done. Let every man perform to the best of his ability the work he finds at hand.

IRRIGATION PRINCIPLES.*

III. ASSOCIATION.—IRRIGATION DISTRICTS.

BY WM. HAM. HALL, MEM. AM. SOC. C. E.

THE large and important canal works of Italy, for the most part, had their origin during feudal times, or in periods soon following those times, long ago when only rulers, governments, rich civil and ecclesiastical corporations, wealthy nobles, and large landed proprietors could afford such expensive enterprises as they necessarily were. There were no such things as communities or associations of small farmers combining to take water out on their own account. The topography of the country, character of streams, and severity of winter climate (in northern Italy) all forbid the construction of small and cheap works which poor landed proprietors could compass, and made necessary the employment of much capital and a high degree of skill and strong business organization to effect the purpose. Consequently, there are but few small private works of irrigation in Italy, and until necessity, under the civil law, forced it, there were no irrigation associations, for the social and political tendency and influence had been all against such organizations.

As a legacy from feudal rule in the middle ages, land holdings were much consolidated into few hands: the canals were owned by government, wealthy nobles and ecclesiastical and municipal corporations, who held them as revenue-producing properties. The lands were leased to tenants; the waters were farmed out in bulk to middlemen who made a business of selling and distributing them to the tenant irrigators. The small farmers and tenants were pressed to the wall by this condition of affairs, and out of it came, on the basis of the common ownership of waters, the legislation providing for association of irrigators.

To end the troubles, the formation of such associations were made compulsory, according to certain general principles of organization; but the details of internal organization were left for each district to determine for itself at the time of formation. Each irrigator and each land owner were made eligible as members. The affirmative action of a majority of the members, representing at the same time a majority area of the property in the district, was required to determine all questions in its control. Thus, the principle of manhood suffrage is coupled directly with that of land area voting, and on this point the system is distinctly a dual one.

The minority is obliged to submit to the will of the majority; and no lands can be withdrawn from a district during the period of time for which it is formed, except by action of the courts and after showing that no interests will suffer thereby. The law made the association of irrigators into districts, obligatory under all works, the old ones as well as those to be built after its passage; so that now all irrigation neighborhoods are formed into districts each deliminated by the extent of irrigation from any one distinct work or unified group of works.

SPANISH, FRENCH AND ITALIAN SYSTEMS REVIEWED.

Reviewing: We find in Spain, France and Italy—the three principal civil law irrigation countries of Europe—that the association of irrigators, for local control of irrigation affairs, in districts, is made obligatory by-law in almost all cases, no matter how the works are carried out and owned—whether by the district itself, by a contracting company, or an individual. The idea is, that the water belongs to the people, however it may be delivered to them, and they must organize to receive and protect their interests in it. The basis of control rests on the voting of lands, and is arranged in a way as far as possible to favor the small holder. Before any district is authorized to exercise the full right of eminent domain, or to contract a fixed debt (issue bonds or debentures), its limits, works, projects, and water-rights are subjected to governmental examination and adjustment, and must receive sanction. In every case the government, or state, reserves the power and authority to compel all such districts to pay their debts and meet their obligations; equally protects the interest of the districts, in arranging the terms of concessions to companies which may undertake to deliver water for their irrigation; and provides that works and rights are, at the expiration of fixed periods, to become the property of the district served, in each case.

CALIFORNIAN IRRIGATION DISTRICT EXPERIENCE.

The communal system of irrigation control was introduced into America by the Spanish, and found footing in California by the establishment of the *pueblo* of Los Angeles, in 1781; and, until the American form of city government took its place, this old

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community continued to be administered as a primitive irrigation district, for the common good of its people.

California adopted the common law in 1850, when it first became a State. As written in my former article of this set, the right of water appropriation became fixed as a custom in mining practice, and was thence extended by custom to irrigation and sanctioned by the courts of the State. Local communities of irrigators in the nature of free associations were formed by the Mormons in San Bernardino Valley in 1857.

But it was not until 1872 that, under the title of "An Act to Promote Irrigation," the first California irrigation district law was passed. It applied to the State, omitting four principal counties, which were excepted from its action on demand of their representatives in legislature. Under its provisions: Districts might be formed, on petition of the owners of land to be affected, by approval of county boards of supervisors. By-laws for the internal government of each such district were to be adopted by "the votes or consent of a majority of the owners of the lands within the district," and had to be "signed by the persons owning a majority of the land within the district." Money to construct works was to be raised by "assessment of benefits" on the land in the district; which assessment was to be made by a commission named by the county supervisors following the estimate and request of the trustees of the district. The amount assessed on each piece of land, immediately on the commission filing its report, became a lien on the property, and had to be paid into the county treasury within thirty days, or was thereafter collectable on civil suit by the county attorney. The works were to be carried out by the district trustees, who were to draw their warrants on the fund in the county treasury in payment for the same. This was a very short, simple though crude law; but was never put into operation. Nevertheless, it contained some features afterward embodied in more aspiring and effective legislation, and some principles which should have been but were not similarly adopted.

In April, 1876, the legislature passed a special act to create an irrigation district to be called the "West Side Irrigation District." This was a long, elaborate and carefully drawn law, the work of an able legal firm; but, as its name shows, was enacted for the formation of one district only. Having specified the territory to be embraced and affected, this law provided:

(1) For the election of a board of commissioners and other officers, such as assessor and tax collector. (2) For the acceptance of the law by ballot of "the qualified voters," and for other elections on the same basis; (3) for the issue and sale of bonds to raise a construction fund; (4) for the levy and collection of taxes to pay interest and principal of bonds; (5) for exercise of the power of eminent domain by the commissioners; (6) for the collection of tolls, water rates and assessments for purposes of maintenance and operation of works; (7) for the construction and operation of the works by the commissioners; (8) for the redemption of the bonds; and, (9) for the general management of the affairs of the district by the commissioners. As stated, the elections were based on manhood suffrage—the ballot being cast by "the legally qualified voters." The construction fund raised from sale of bonds, was to be placed in the State treasury, and thence transferred to the district treasury, as required. Taxes collected for interest on and redemption of principal of bonds, were to be deposited in the State treasury, and such interest and principal were to be paid thence by the State treasurer. But the State was not in any way to be responsible for the debts of the district. All property, real and personal, was subjected to taxation for payment of interest and principal of the bonds.

This law was never operated, owing to the opposition of the principal land owners in the district, and the supreme court declared it inoperative on technical grounds.

THE GREAT WATER-RIGHTS CONFLICT.

From 1878 to 1886 California was shaken by the great irrigation water rights and hydraulic mining débris conflicts. In the former year an act providing for an investigation of those subjects was passed. Of the working and results of this law, as relating to irrigation, I shall speak in a later paper. After its passage, for five sessions the legislature was divided into hotly contending factions on the mentioned points at issue, and beset by a lobby the like of which for activity and persistency, at least, probably was never surpassed.

Propositions of all kinds relating to irrigation were advanced, only to be refused passage—choked to death in committee, or left unconsidered on the files. At least one irrigation district bill was introduced at every session; and some of these were most carefully prepared and arranged as parts of proposed systems, believed, in the light of extended investigation, to meet every requirement of irrigation development as these had shown themselves in older countries. Meanwhile, the courts disposed of the two great questions at issue. Hydraulic mining as then practiced was declared to damage private property on streams below, and was stopped by injunction. The irrigation water-rights question was decided in favor of the riparian proprietors as against the appropriators.

Thus, when the legislative session of 1887 came, the hydraulic mining and water appropriation factions had given up their fights, and the way was cleared of personal and class conflicts and opened for general irrigation legislation. Many of the holdover and returned members of legislature, however, and the public press, were suspicious of every person who had participated in the former struggles, however conservatively, and no matter how fair and wise his course had been. Thus the opportunity was presented for new champions of irrigation to come to the front. The supreme court in one of its riparian rights decisions had intimated that the water-rights conflict should be settled by providing for condemning riparian and other conflicting rights, and paying for them.

Under these circumstances the bill which has since become famous as the California irrigation district law was introduced, simultaneously, into the senate by Mr. Abbot and into the assembly by Mr. Wright. It was first considered and voted to passage in the assembly, went to the senate, was substituted for that of Mr. Abbot on the file, and became a law with Mr. Wright's name attached as its author. In the condition of affairs described, the legislature was ready to pass anything that purported to be for the benefit of irrigation and which was shaped to avoid the prejudices of the older members. The Abbot-Wright bill was so shaped. It was fixed to pass. If it was not all it should be, let it go; it could be amended or

added to later on. Don't attempt too much. Such and such an interest will oppose this feature, if added; such and such an interest will oppose that idea, if advanced. We *must accomplish something* at this session, right or wrong. Such was the spirit in which the bill became a law.

THE SO-CALLED WRIGHT DISTRICT LAW.

Except as to details and as to a point presently mentioned, this Irrigation District law as originally passed was simply an adaptation and in many parts a copy of the first two sections of the general district act of 1872, and the special district act of 1876. There was nothing new in it, except by way of amplification of detail intended to render the legal proceedings, to be had under it, more plain, and to do away with possible conflict with general State laws relating to election and assessment and collection of taxes.

Districts were to be formed on petition of land owners and by the action of supervisors, as provided by the act of 1872. In all else of fundamental importance it followed the act of 1876, except that it did not make the State treasury the depository of district funds, and did not make the interest and principal of bonds payable from that central office. This act has been amended at every session of the legislature since its passage, but only as to details. The principles and main features remain the same. By it, on petition of fifty or more owners of land in a proposed district, the board of supervisors in the county where situated takes action to form the district. The district is governed by a board of commissioners, elected by manhood suffrage, just as are county officers except that the machinery of election is in the hands of the district officers. The question of bond issue to raise a construction fund is voted upon in like manner—all qualified electors of the district, voting. The fund raised from sale of bonds goes into the district treasury, in charge of the district treasurer—an elective officer. It is disbursed thence, on warrants drawn by the directors. All property, personal and real, in the district is assessed by a district assessor; on it taxes are levied by the directors, to raise money for payment of principal and interest of bonds. These are collected by a district tax collector. After payment the returns are transferred into the district treasury by the tax collector, and are thence paid out on orders of the directors, for the purposes specified.

The operation of this law has resulted in great disappointment in California. It has not been the success predicted for it. It has produced many instances of flat failure. Attacked and resisted in operation by the larger land holders within the districts formed, it was thrown into court, and although its constitutionality has been four or five times upheld by the State supreme court, it is still the subject of contest on the same point before the National supreme court. Some facts and details in the history of its operation will be drawn upon for illustration in my next article. For the present let us look broadly at the general result and the reasons therefor.

AN UNFORTUNATE DISTRICT EXPERIENCE.

The purpose of the California Irrigation District law was certainly a good one—the proper one to be held in view and worked for at the time of its passage, as it had been for ten years preceding. As I have in this paper shown, the association principle is essentially a corner stone of every good irrigation system. We should have had a practical and operative irrigation district law in California ten years before the so-called Wright law was passed, and would have had, at least six of those years sooner, but for the contention whose history I have endeavored to outline. Many of the greater irrigation developments in this State should have been brought about by the agency or with the coöperation of associations of the farmers whose lands they were intended to serve. The irrigation district is a good and desirable thing when so organized and vouched for by the higher political authority—the State—as to promptly command public respect. It is a questionable feature in any political social system when districts may be so organized as to become a means of fraud on the public and injustice to its own citizens and land owners.

The Irrigation District law in California was a step in the right direction. That it was exactly the right step, is open to question later to be considered in these articles. But the fatal mistake in taking it was that the step was unguarded—an incomplete move—a half-way measure, only. And it is this fact, more than any other, more than any defect in the law itself, which has been the cause of its failure.

In attempting to introduce this civil law institution of district association into our common law irrigation system, the fatal mistake was made of not establishing also its inseparable companion institution, state supervision. While the so-called Wright Irrigation District law of California has produced some apparent successes, looked at broadly, its operation has been little removed from disastrous failure; and, for the reason given. This truth in no way bears upon the value or validity of bonds issued under it. The failure has been largely proportional to the agony and disaster left in the train of conflict which has been necessary to uphold the law and its bond issues. These contentions would not have occurred had the law been properly guarded. This point will be the principal topic of my next article.





WINDMILL AND RESERVOIR NEAR GARDEN CITY, KANSAS.

IRRIGATION IN SOUTHWEST KANSAS.

EXPERIENCE TEACHES PRACTICABILITY OF PUMP IRRIGATION.

BY J. W. GREGORY.

IRRIGATION sentiment has made greater progress in western Kansas during the past two years than in all the previous history of the country. From the inception of the first experiments in this line, upward of fifteen years ago, up to the present time, there have been more or less systematic efforts to put this region on a practical irrigation footing. But that terrible thing which the editor of THE AGE tells us once occurred in Nebraska, dampening irrigation ardor which a dry season had aroused, has happened here also—it has rained. If it only would, each time, rain enough, and often enough, that would be well enough. On the other hand, if the seasons were uniform as to lack of rain, people would not have been so slow to adapt themselves to the actual condition of things, and irrigation would have speedily been made to so supplement precipitation, when settlement was attempted at all, that but few acres of the land ever would have been settled upon in vain. But the annual rainfall, which averages about twenty inches in that part of Kansas west of the 99th meridian, is so unevenly distributed that in some years we have only eleven inches, while others receive as much as twenty-eight inches. One great advantage attaches to the fact that three-fourths of the annual rainfall occurs in the six months beginning with April; but even this most obvious advantage, which gives a larger proportion of moisture to growing crops than the records of annual precipitation would appear to warrant, and makes the winter seasons dry, is marred to a considerable extent by a midsummer drouth period, which never fails to be in evidence during the early half of July. So that, whether the season be one of medium, maximum or minimum rainfall, it is all the same. There is sure to be one portion of the crop-growing time in which irrigation is the sure and only key to success.

TAKING CHANCES.

But people have been slow to realize this fact. The promise of the spring is always so alluring, and that dry time in midsummer so short, and the later rains bring out the late crops, and it always seems that the farmer "came so near it" that he certainly can succeed next year. Then, there is often a fair wheat crop, and occasionally a very heavy one—what is called "a steam-winder," by a 'steemed friend, who is more emphatic and picturesque than accurate in his characterizations. And so it has been that the people, being unacquainted with the methods and practical value of irrigation, have been slow to adopt new ways and have taken chances, year after year, which have not eventuated to the advantage either of country or people. It has required a long series of the most emphatic lessons of experience to make anything like a general beginning at realizing that he

who expects to make a steady business of living in western Kansas would better prepare to irrigate.

A certain ward tough, in a western city, about the time of the recent election, was quoted as asking a friend, who seemed slow to take a hint about an important matter, "If he would take a tumble if a brick house fell on him." It has taken hints just about as forcible to cause our people to "take a tumble," but they seem to have pretty nearly taken it, of late.

ON THE SKIRMISH LINE.

In the evolution of irrigation processes and results in Southwest Kansas, the people in the vicinity of Garden City have had the fortune to serve as pioneers and exemplars, both as regards irrigation from streams and by the more recently utilized pumping methods. From several systems of ditches network a body of land in Finney and Kearney counties, comprising about 150,000 acres of irrigable land. But a minor fraction of this area is under cultivation, however, largely for the reason already referred to—that people continually risk trying to get along without irrigating—and also in large part because of the continued failure of ditch managers to so construct headworks and prepare ditches and reservoirs as to supply the necessary water to insure the success of those attempting to irrigate. The purveyors of water in this region, no less than those who should have used it upon their crops, have had to learn by experience.

It was uncertainty of ditch supply, growing out of inexperienced and inefficient management, which led to the employment of the pumping plant in the first place, the latter method having been inaugurated but five years ago, but it is proving a most important factor indeed in the problem of settling the Great Plains with a *permanent* population. In cost, as compared with ditch irrigation under the most favorable circumstances, "figures" would make it appear less economical, the cost of installing a plant for irrigation by pumping, on valley lands where the lift is fifteen to twenty-five feet, being about $15 per acre; but, as an available aid to the man who is seeking to make a living out of the soil of the semi-arid portion of the Great Plains, it is rapidly being demonstrated as the practical and popular method for obtaining quick and sure results. It is a means within the reach of the individual, can be employed without delay by the isolated settler and embroils the irrigator in no complications either with ditch company or with other users of water. It may be used extensively, or in a small way, to a most beneficial end, and supplements and is supplemented by other features of the farm in so many ways that the apparently high cost per acre of an installation counts for little when the benefits and profits are reckoned. For example, the same pumping outfit which waters the ranchman's cattle may be made to irrigate a garden which will furnish his table with small fruits and vegetables. The pump and reservoir which irrigate only a small tract of ground, thus insuring a supply of food for the family table, will, in multitudes of cases, make it possible for the family to subsist through drouth and crop failures on the unirrigated lands and thus bring them around to the years of abundant rainfall when big crops are raised—big enough to make up for lost time. This has been demonstrated as a fact, already, and it applies to so large a proportion of the tracts of land which have been settled upon in Western Kansas that the remarkable success of those who have employed pump irrigation in the vicinity of Garden City the past five years, has given a great stimulus to development along this line. Furthermore, it has proven an aid instead of a rival to the ditches, because there is all the upland, readily accessible to water, which the latter can possibly supply, and the pumping plants in the nooks and valleys operate as an insurance of success and a stimulus to effective effort whose influence extends to and benefits the lands where water is too deep for economical pumping.

ÆGYPTA!

The season of 1894 has done more than had all of its predecessors to bring pertinent and practical facts forcibly to the notice of the people concerned in the development of Western Kansas. The drouth and crop failures upon unirrigated lands were so widespread that a good deal of country ordinarily reliable for farming by the ordinary processes produced very little. The irrigation farmers about Garden City had their customary big crops of vegetables, fruits, alfalfa, etc. Before the season was well into its latter half, wagon loads and caravans of the products of the irrigated small farms were going out to all points of the compass, beside the far greater proportion which found transportation by rail to more distant markets. Consignments of sweet potatoes, for example, were shipped to Pueblo, Denver, and as far as Ogden, Utah. Wagons came across the country, in several instances from distances of upward of 150 miles, loaded with grain, broomcorn or stock hogs, to sell in order to take back loads of vegetables. Farmers came singly, in pairs and in companies, some of them bringing their wives along, to stay from a couple of days to a couple of weeks among the small irrigated farms, getting information that would enable them to "go and do likewise." At one time a passenger coach load of fifty-two farmers came, by special arrangement, from Sherman county, in Northwest Kansas, necessarily coming a long way around, and were shown all that the Garden City people could show them in the way of demonstrations of practical and paying results. Another party of twenty came, at another time, by excursion rate, from Pawnee county, for the same purpose.

EVERYBODY WELCOME.

One feature of the conduct of the farmers and people in general about Garden City deserves special mention, and that is the fact that, whatever success they have secured, whether by ditch irrigation, by pumping, by the introduction of new crops, or whatever has contributed to their advancement, they have not sought to keep it

"A close monopoly by patent right"

or otherwise, but have continually placed their information, the results of their work and experimentation, at the service of their neighbors and visitors, taking the time and teams necessary to show around the parties of information-seekers, not to sell them land, or to influence them to settle at Garden City, but encouraging them to carry the irrigation gospel to other localities and showing them, as far as possible, how to succeed on their own lands. There may be an occasional grumpy, selfish individual who "isn't working for other people," but the writer does not know of a solitary irrigator in Finney county who has not willingly furnished all the information at his command to enable any one, in any locality, to start right on the road to the successful establishing of a home of his own. Hundreds of

inquirers who have visited Garden City the past two seasons can testify to the broad-gauge, open-handed reception they have uniformly met.

GOOD SEED WIDELY SCATTERED.

The results of the demonstrations of the successful irrigators by pumping in this locality have reached very substantial proportions, and, though it may rain again and thus dampen the enthusiasm of would-be irrigators—as has so often happened before—yet the widening circles of the influence of these achievements have already spread to many and remote localities, and within the next three or four years there will doubtless be scores of more or less prosperous irrigation centers, each adding valuable contributions to the sum of progress toward the general success of the settlers upon the Great Plains, and the development of the wonderful latent resources of this favored region.

MODERN INSTANCES.

Perhaps nothing would be of more interest in this connection than a few details as to people, what they have done, and the results.

A. S. Parson, who has five acres, one mile from town, irrigated by two ordinary pump cylinders operated by an eight-foot steel windmill, and using a small reservoir, produced 1,200 pounds of the finest onions this season on one-sixty-ninth of an acre, and upward of 3,000 bunches of celery on one-fortieth of an acre. The ground was as heavily manured, as carefully prepared, as thoroughly cultivated and as faithfully watered as any eastern market garden or Southern California orchard. Mr. Parson is a skilled horticulturist, but his processes are simple and easily understood, and he gives all his neighbors the benefit of his knowledge, if they see fit to profit thereby. The same plat of ground that produced the celery had also previously produced lettuce and radishes, which sold for $27.40, earlier in the season. The celery was planted so close (five by ten inches apart) that, by surrounding the plat with boards, no hilling up was required to blanch it. The accompanying cut shows the crop just as it grew, being photographed as it stood in the plat.

Capt. E. L. Hall has ten acres devoted to fruit mainly, producing vegetables between the rows of trees as yet. His water supply is furnished by two six-inch pumps, run by eight-foot windmills. Some years ago, the ground he occupied was bare prairie, untouched by the plow. At the recent Finney county fair he exhibited sixteen varieties of fine apples from his orchard, and his potatoes, sweet potatoes and other vegetables were as fine and as abundant as could be desired. Across the roadway from him, T. J. Dyke, whose tract is but three years from the sod, makes a specialty of Irish potatoes, and his crops rival those of Potato Land (Greeley) itself.



APPLE TREE, FIVE YEARS OLD, NEAR GARDEN CITY.

THE ROOF-TREES GROWING.

L. L. Doty, east of the city, irrigates a thrifty orchard and grows vegetables by the aid of an eight-inch pump and twelve-foot mill. Across the way, A. Bartlett has vineyard, orchard and garden, and the roadway between is shaded by three rows of trees, one on either side and one row down the middle, making a beautiful twin avenue. Among others who are pioneers in pump irrigation are W. R. Grace, E. J. Johnson, John Simon and J. C. Allen, each of whose homes, with the methods pursued and results obtained, would furnish material for an interesting separate paper.

Another grower has a great field of melons, grown for seed, for the house of D. M. Ferry & Co. Seed growing by irrigation is developing into an important industry, and the seedsmen tell us that the seeds are equal to the best, while the yield is comparatlvely certain and large in quantity.

It would be impracticable to give, off-hand, anything like a complete list of the persons in this locality who are employing pumping plants for use in irrigation. There are upward of seventy-five installations now in use, and the number will be largely increased the coming year. At many other points in Western Kansas, notably at Goodland, Sherman county, at Tribune, Greeley county, at Larned, Pawnee county, at Great Bend, Barton county, and at Dodge City, Ford county, pumping plants are already in successful operation and leading to the establishment of very many more. Oddly enough, by far the most expensive installations for irrigation in the State have been put in place the past season in the humid half, the largest of all being that of G. M. Munger, of Eureka, Greenwood county, in the southeastern portion of the State, whose installation costs in the neighborhood of $15,000, and is designed to irrigate at least 500 acres of land, though it has capacity for more.

FISHY, VERY FISHY!

Among the by-products, so to speak, of the windmill and reservoir system of irrigation are the production of ice, which may be carried to the extent of being a great aid to dairying and to the cold storage of perishable products, and the production of fish. The fish pond, by the way, may easily be made to rank above the old cow and the poultry yard as a reliable and prolific source of food supply, judging from the present shape of development here. The German carp has been tested most extensively, so far, but the black bass, channel cat, mud cat, and a few other varieties may be found in some of the ponds. In the spring of '93, E. J. Johnson "rented" seven carp to L. L. Doty on shares. They were put into Doty's pond in May, and in the fall the water was drained off, and Johnson received back his original seven "head" and eleven hundred young fish as his half of the increase of the plant. Doesn't that beat h—h—henneries! The remarkable fecundity of the finny tribe renders it an easy matter for any one who has a small pond to soon have it fairly teeming with fish. If well fed, they grow rapidly; if a pond is over-

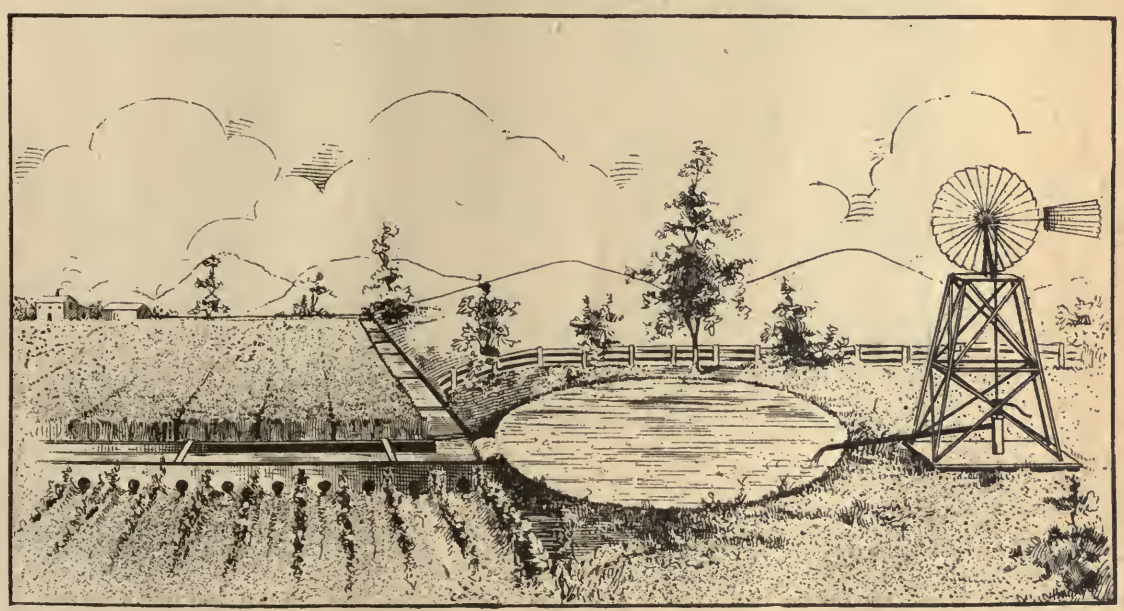


A PUMPING PLANT AND CABBAGE FIELD NEAR GARDEN CITY.

stocked, the fish underfed, they simply do not grow so fast, and the big fish eat up the little ones—live off their *poor* relations, as it were. There is something that smacks of humanity in this characteristic; but whether the trait is regarded as a parallel or an opposite to human action will depend somewhat upon the reader's financial condition and political basis. At any rate it makes a well-stocked fish pond a sort of self-regulating food mine—provided there is some feeding done. The fish learn very readily where to look for the food, and also to come at call. Capt. Hall, for example, first taught his fish to come at a whistle call, and later used a small hand-bell for the same purpose; and, the past season, Ex-Senator John J. Ingalls, Gov.-Elect E. N. Morrill, Congressman Jerry Simpson and wife, and hundreds of visitors of less note have, with much interest, as Senator Ingalls expressed it, "Seen the fish come to a late breakfast at the ringing of a bell." They come like schoolboys after a basket of red apples, or candidates for a fat office, and pieces of bread thrown upon the water are speedily surrounded by a wriggling, nibbling mass of finny babies, each eager for a bite. The big fellows are more shy, but, if strangers are not too much in evidence, occasionally the water will begin to eddy and boil and a great carp, looking, as one excited visitor expressed it, "'z big 'z a bar'l," makes a dab at the coveted biscuit and a big piece of it disappears.

DOES IT PAY? IT DOES.

The experience of those who have tried pump irrigation the past five years in this locality demonstrates that it pays so well that a man can be sure of making a good living for an average family off five acres or less if the tract is well handled. All sorts of field, garden and fruit crops of the temperate zone are grown, many of them with remarkable success. Apples, plums and cherries are the surest fruit crops, and pears, apricots, grapes, etc., do well. Peaches bear only an occasional crop, but a very heavy one when at all. A wide range of small fruits is covered, strawberries and gooseberries being leaders. Melons, cucumbers, in fact all sorts of vining crops thrive remarkably, and sweet potatoes, cabbage, celery, onions, tomatoes, peas, beans, Irish potatoes, beets, turnips, etc., produce with certainty and in abundance. From $50 to upward of $200 per acre, net, have been realized through the experimental stages of the work. Much better averages may be confidently looked for henceforward as experience is broadened. Finney county growers, through the medium of a live horticultural society and a county agricultural society, are exchanging experiences and stimulating one another to greater and more effective efforts. The small irrigated farm, the foundation of the ideal home of the future, with its combination of old-time independence with modern city conveniences and sure results, is already an established fact in Western Kansas.



A DESIGN FOR AN IRRIGATION PUMPING PLANT

A Hardy Fig is claimed to have been introduced by J. R. Johnson of Dallas, Texas, which is attracting attention in New Mexico. If this is anything "new," we would like a further description of it, as the fig has long been grown in a small way, successfully, as far north as Illinois and New Jersey, though often thought as only adaptable to the farther south. There is no reason why this old variety may not succeed in any of the irrigated valleys of the southwest.

Wild Rye Grass.—The native hay harvested by the Indians in great quantities, baled and sold in the coast markets, is well known to travelers over the far northwestern roads. We have seen it almost hiding the horses and cattle grazing among it. The editor of the *Washington Farmer* says that Sheriff Meade of Kittitas county gathered seed and sowed an eighty-acre field and pronounces wild rye the best forage plant that can be grown in irrigated fields.

THE NEW FODDER PLANT.

THE VEGETABLE WONDER OF THE SEASON.

SACALINE—*Polygonum Sachalinense.*

ALFALFA must talk less and show more of modesty. Fish stories pale beside the tales of the new vegetable wonder. Even the glories of irrigation are of little avail in comparison with what this new forage plant, Sacaline, promises to do for agriculture in the drouth-stricken region. Veritable forests of fodder may replace the long time favorite bunch-grass of the dry mesas. Such at least is the inference that one draws from the descriptions of the latest aspirant for high rank among the forage plants. And it has high indorsements from men whose word may not be gainsaid. Prof. L. H. Bailey, the conservative botanist and horticulturist at the Cornell University Experiment Station, "believes that it will be a good thing for some parts of the country." Prof. J. L. Budd, of the Iowa Agricultural College, considers it as "very valuable in the dry West as a forage plant." London *Garden* says that "cattle are exceedingly fond of it," and that "as a forage plant it has an assured future." Its analysis compares favorably with clover and alfalfa. The various other English, French and German horticultural journals praise it highly. Prof. L. H. Pammel of the Iowa Agricultural College writes as follows in *Garden and Forest*:

"It is not only perfectly hardy in Central Iowa, as far as cold is concerned, but it stands the dry weather remarkably well. We have had no rain to speak of since the latter part of July, but this plant is as green at the end of September as it was early in July. The root stock of this plant is sent out in all directions. The original plant has been in a dry place for many years, but in all this time it has not once been killed back. It is a remarkable grower. Early in June stalks were fourteen feet high. What is needed in the West is a plant that can be used in August and September when pastures are nearly always short. If the first and second crops could be used for the silo (it is said they can), the crop in August and September would be excellent for immediate use."



A TYPICAL PLANT OF SACALINE.

Charles Baltet, a well-known French agriculturist, says of it in the *American Agriculturist*: "The severe drouth which Europe passed through this year, will, I think, enable horticulture to come to the aid of agriculture with a new forage plant, giving such help as it did to vine-growing twenty-five years ago, in introducing the practice of grafting vines on the phylloxera-proof American stocks. The proposed plant is the Saghalin knot-weed, *Polygonum Sachalinense*, called in France Sacaline, a perennial plant, hardy and vigorous, bearing with equal indifference extreme of heat in summer and cold in winter. We have cultivated this plant since its introduction into France,

for purely decorative purposes. The young, white shoots are eatable, but they do not rival asparagus, though its splendid foliage may be made use of for garnishing dessert and for packing fruit. Moreover, the experiments of M. Doumet-Adanson on the forage uses of our Polygoneæ transmitted to the *Academie des Sciences* of Paris by M. Duchartre, and the communications I have made to the *Societe Nationale d'Agriculture* of France have brought the plant into notice, and called the attention of farmers to it. The Sacaline was discovered by the Russian explorer, Maximowicz, in the Isle of Saghalin, situated in the Sea of Okhotsk, between Japan and Siberia, a moderately large island, ceded to Russia by Japan in exchange for the Kurile Archipelago. In 1869, Edouard Andre noticed this new introduction, in the *Jardin d'Acclimatation* of Moscow, where it was exceedingly decorative, and brought it into France, telling us of its vigorous growth both above and below ground. The roots branch on all sides, and pass horizontally from the rhizomes, penetrating the hardest soils and giving origin to new shoots which further increase the size of the clump. The stems are numerous and closely set; they vegetate early, and are not long in attaining a height of nearly ten feet. Small, long, zigzag ramifications develop in the middle and at the top of the luxuriant plant."

Thus we have tried to give a fair consensus of the published opinions on this important introduction. The favorite, because quickest means of propagation is by setting the young plant, but in order to give our readers an opportunity to thoroughly test the Sacaline, we have made arrangements with the fortunate introducer, A. Blanc, of Philadelphia, for a supply of the seeds, a packet of which we will send gratis and prepaid to every reader of THE IRRIGATION AGE who has paid, or shall soon pay, his subscription for 1895. All applications should be made direct to the office of THE AGE.

M. Blanc writes us that we should sound a warning that some seedsmen last season were badly "fooled" by certain parties palming off upon them seeds of *P. Cuspidatum*, which is a comparatively worthless species of the same genus. But these seedsmen sell the spurious seeds (not sacaline at all) at a very low price, while the true sort is not sold at wholesale at less than $25 a pound, and when first introduced sold at above $1,000 per pound. As the supply increases, from season to season, the price lowers of course, but is still held at a high figure, because it is in very great demand.

This use of *P. Cuspidatum* is most unfortunate as it spreads freely, and as it is claimed to be a bad weed, is likely to work great harm where planted, for itself, and because it is apt to reflect upon the true sacaline for which it was bought. A complete illustrated pamphlet on sacaline will be sent on application to Mr. Blanc as above.



SACALINE GROWING ON A DRY ROCKY MOUNTAIN AND ON WET LANDS.

THE DIVERSIFIED FARM.

Short, practical articles, notes of experience and observation, are invited from the readers of THE IRRIGATION AGE who are interested in the promotion of the idea of the small diversified farm providing to the fullest economical extent all of the various articles of food, clothing, etc., required by the family.

UTILIZE THE WIND POWER.

BY W. C. FITZSIMMONS.

THE wind, like the poor man, is always with us. It is often, if not generally, a source of complaint against the climate. In no considerable area in the United States is there a demand for more wind. It is, indeed, the specially disagreeable feature of nearly every climate. The cold north winds of winter and the raw winds of March, as well as the parching and drying winds of summer, are alike disagreeable if not destructive. But the wind is everywhere, and always a source of power, and should be utilized by the farmer as a helping hand. Windmills are comparatively cheap, and many of them are very effective. Great improvements have been made, in appearance at least, upon the old-time windmills, and a new and possibly more appropriate nomenclature is now employed whereby we are introduced to "wind engines," "aermotors," etc. Still, all these improved devices are windmills, though cuts of them, as seen in the advertising columns of THE AGE, differ essentially from the old drawings so familiar to readers of the exploits of that doughty knight of the windmill, Don Quixote de la Mancha.

There is scarcely a farmer in the country who can really afford to be without a good windmill. The uses to which such a machine may be put on every farm are various and may be made to yield a profit. To be sure, there will be some days when the mill cannot earn its keep through no fault of its own, but on most farms a little attention from day to day will supplement the lack of motive power, and enough work may be done on breezy days to tide over a "doldrum" of even several days at a time. Some day—soon perhaps—electrical appliances will be attached to the windmill, enabling the farmer to store power as he now stores wheat or cider, to be drawn upon for use whenever convenient. But the windmill as it is at the present time is sufficient for most purposes to which farmers wish to apply power thus derived. Perhaps one of the most common uses to which the power of the wind is applied is the pumping of water. Raising water by hand, even from shallow wells, is very hard work, and too slow a process to be thought of on stock farms, or when required for irrigation on a farm however small. With a good well, however deep, and a modern type of windmill, water for household purposes, stock, and to some extent for irrigation, may be easily and cheaply raised. But the pumping of water is only one of the valuable functions to be performed by the windmill. At comparatively small cost, belts, shafts and gearing may be provided whereby the power of the wind may be made to turn the grindstone, move the churn, shell the corn, and grind it both for the use of the family and the stock, as well as to do a number of other errands, such as elevating grain and baled hay for storage in the barn. Cheese and cider presses may be operated by the same power, and fodder and wood cut also. In fact, the profitable uses of the windmill are many, and as users of them acquire more experience the long list of chores for the windmill will be lengthened, while that for the boys on the farm may be shortened in proportion. Like the small boy, however, the windmill needs an occasional dose of castor oil to keep it in condition to do its best work, and this amount of attention to its needs should be freely given. In short, the modern windmill affords the farmer the most ready and cheapest means to apply the enormous force of the wind to useful purposes about the farmstead. It is an easy way to use to the best possible advantage a waste product of illimitable amount, which costs absolutely nothing to produce, and which may nearly always be relied upon to ease the farmer's toil, as well as that of his family, while adding a hundred hitherto unknown comforts, not only to the farmer and his household, but to his flocks and herds also.

THE SUNFLOWER AS A FARM CROP.

BY JOHN TRIMBLE, SEC'Y OF THE NATIONAL GRANGE.

THE discovery of sunflower oil as a food was an accident. It being recommended to a Russian farmer to prevent sickness, he tested its remedial values, and then began to use it as food to his family and the cake to the stock. So popular for oil and food has the sunflower industry of Russia become, that in 1881-2 there were 367,889 acres in cultivation; in 1886-7, 704,496 acres. Seed is of the large and small varieties, the latter used for oil, the former eaten the same as peanuts. A Russian farmer gives the yield of seeds at 1,450 to 1,600 pounds per acre, and nets the grower $28 to $31 per acre.

An American chemist, living in St. Petersburg in 1868, made a compound lard, taking sunflower oil as the base, which was pronounced superior to hogs' lard in every respect for domestic purposes. Some of this compound was sent to a food exposition in Holland, and took the first prize as pure refined hog's lard. He then produced, from the same oil, oleomargarine, which also took a premium as creamery butter. From the residuum of the oil he manufactured fine washing and toilet soaps, which are standard brands in Europe and South America. Druggists use the refined oils in preparing liniments, salves and hair lotions. When properly treated, it is used on the most delicate machinery as a lubricator.

VALUE AS STOCK FEED.

The annual output of all the sunflower oil mills in value is estimated at $1,700,000 for the oil only. Oil cake is put at $600,000. The oil cake is largely consumed in Russia, Germany, England, Sweden, Denmark and Holland, as feed for cattle. The stock raisers and farmers of these countries regard the oil cake

as the best food to be obtained for cattle. They claim or it superiority over hemp or rape seed for producfing flesh on beef cattle, and equally as good for increasing the supply of milk in milch cows. A German farmer reports that he increased the flesh on an ox three pounds per day by feeding on sunflower oil cake. These people also hold it in high esteem as a horse feed. They say it produces flesh and gives the hair a lively, slick appearance. The dried cups are fed to sheep, and the faulty seeds are used as feed for barnyard fowls. In many sections where wood is scarce the stalks and shells are used as fuel, which answers as a good substitute. The ash from the sunflower contains a large per cent. of potassium. Experiments have proven that 1,000 pounds of dried stalks yield 57 pounds of ash and from 1,000 pounds of ash 350 pounds of the best potassium is obtained. According to the analysis of chemists, the ash of the sunflower contains about thirty per cent. of potassium, and it is also claimed by these scientists that if the soil is very rich, the plant will take up fifty per cent. of potassium. The ashes are sold to soap makers. From the fiber of the stalk is manufactured the finest varieties of writing paper, which bears a close resemblance in color and texture to parchment.

CULTURE.

Mr. Duncan, an extensive cotton planter in the Mississippi bottom, who visited Russia last year for the purpose of gaining information in regard to the culture of the sunflower in that country, gives his observation as follows: "The Russians who grow the plant generally sow the seed after a crop of wheat and rye has been harvested from the land. Some sow after oats and buckwheat, but have found it less profitable to sow after the latter, as the buckwheat takes up such a large per cent of potassium from the soil that the flower does not pay. It thrives and heads well after crops of rye and clover. The land intended to be planted is thoroughly plowed in the fall and left until the next spring, at which time the seeds are sown, either in drills or broadcast. If in rows, they are planted from twelve to twenty-four inches apart, depending largely on the fertility of the soil. On some of the rich, black lands, they grow from four to six crops without resting the land."

REFUSE AS MANURE.

Mr. Duncan continues: "The Russians estimate that the stalks and leaves of one crop, if left on the land, will manure the soil sufficiently to yield six or more crops consecutively without additional fertilizing. The roots of the stalks soon rot in the ground and leave about one ton of manure per acre in the soil, which is very fine for the next crop. The plant requires but little attention and labor after planting. When it is about ten or twelve inches high, the soil should be thoroughly cleaned of grass and weeds. That is all that will be required until harvest. Harvest time varies according to soil, climate and exposure of the flower to the sun. The usual time is fixed from September 1 to October 15 When the seeds are fully ripe, the heads of the flowers are cut from the stalks and placed in drying sheds for the purpose of curing them, the same as curing leaf tobacco. When the flower is fully dry, the seeds are threshed from the cups, and screened and run through a fan mill, and are then ready for the seed mill."

In conclusion, Mr. Duncan says: "After carefully examining every feature of this new and novel industry, as conducted by the Russians, I am induced to believe that with our improved modes of farming, together with our climate and soil, the cultivation of the sunflower can be made one of the best paying crops that the average American farmer can raise. When we take into consideration the great saving of labor and expense in producing the crop ready for market, as compared with others, it is wonderful."

ONION CULTURE BY IRRIGATION.

IN response to inquiries from subscribers we take pleasure in presenting the following excellent account of successful onion culture in central Washington, by W. W. Corbett. From similar methods followed in the far southwest we have seen equally satisfactory results. The irrigation of onions requires careful handling, as water must not reach the bulbs; therefore the grade of the onion ground must be regular in the extreme, of gentle grade, the little ditches carefully formed, the water applied with extra care and only in sufficient quantities to keep the soil from drying. The quality of irrigation onions is of the very best. Mr. Corbett's article is in the form of an interview with a farmer on the famous "school section" near Yakima.

In response to the usual interrogatory as to his "age" in this county, Mr. Rock said "a little over four years."

"Have you been ranching all the time?"

"Yes; the first two years I was a renter. I came from the Wolverine State and had much to learn, and tried my hand before contracting for a purchase. I have been on the section for two seasons."

"How many acres have you, and what kind of farming are you doing?"

"I have nineteen acres, and am growing hops, alfalfa, potatoes, fruit and garden vegetables."

"You have had considerable experience with onions, I understand?"

"Yes, I have grown them more or less as a sort of specialty ever since I came here. Not so largely as some others, however."

"Will you plant onion seed this year?"

"Yes; I have always done well with the crop and shall grow two acres this season."

"What varieties do you prefer?"

"My principal planting will be the Danvers Yellow and the Red Wethersfield, but I shall plant a small space to each of Silver King and Prize Taker, just to see what they will do. Both are very large varieties and will do well here."

"What is your method of preparing the ground for the crop?"

"I plow deeply, pulverize with a spring-tooth harrow and finish up with a light harrow. In this way I get a fine, mellow seed bed."

"How do you put in the seed?"

"With a Planet drill, using two pounds of seed to the acre. The drills are fourteen inches apart, giving plenty of room for cultivation. Mine is a hand drill."

"When do you plant?"

"I have begun already, and would advise any one intending to grow onions to get at the seeding at once. Now, when it is freezing more or less at night, I use the drill only in the afternoon, when the ground has softened."

"Is land that is entirely new adapted to the crop?"

"Certainly. In my own case I cleared the sagebrush off and immediately put in the seed; the result was entirely satisfactory."

"Have you ever sown the seed broadcast?"

"Yes, with fair results; but drilling is preferable, as it gives a good chance to get rid of weeds."

"Are weeds very troublesome?"

"O, no; the pig weed and the 'horse' thistle are about the worst we have to contend with, and they are not bad."

"When do you cultivate the first time?"

"As soon as the weeds appear and I can follow the rows. I use a cultivator attachment to my seed drill."

"How many times do you cultivate?"

"I have found it necessary to cultivate but twice; but if some of the weeds escape the cultivator I go over the ground late in the season and pull them out by hand."

"About the thinning—how is that done?"

"So far I have waited until the young onions are big enough to sell in Yakima, then pull, tie in bundles and take them to market. In this way I get a neat little income for the work of thinning, and leave the rest to grow for fall use."

"How far apart do you want the plants to stand?"

"Wethersfield about three inches. Yellow Danvers two to two and one-half inches; larger varieties four inches or more."

"What is your method of harvesting?"

"When the onions are ripe, pull by hand, throwing the onions of six rows together in a sort of windrow; let them lie there in the sun for about two weeks, then top and sack if to be sold at once. If to be kept, make a crib like an old fashioned corn crib, elevated a little from the ground, narrow and not too high, say three feet wide and six or seven feet high. It must be well ventilated. If not sold before winter, bank up with hay all around and over the top. If very severe weather is probable, increase the thickness of the hay. In this way the onions will come out all right in the spring. Some of my neighbors have just opened their cribs and find their onions perfect."

"What do you consider a fair yield?"

"As a general thing, 350 to 400 bushels per acre, or say eight to ten tons, as they sell by the ton in this country."

"What is a good paying price?"

"Well, it costs about $25 per acre to grow the crop. At $20 a ton the crop is not a bad one. Just now the price is $60 a ton, which, you see, brings a pretty good net return."

Spray and Insure Your Crop.—Unusual dropping of apples continued late the past season. Valuable testimony in favor of spraying apple trees has developed during 1894. Many advanced orchardists have made note of the effects of timely and proper spraying of orchards, and the results have been remarkable. It has been found that orchards sprayed in the spring and early summer have made a much better growth and have held their fruit much better than those not treated. Winter spraying for the bark scales and some other insects is the better plan. In some sections it is believed that spraying, at a cost of say $3 per acre, has saved fruit worth at least $50. These calculations have been made by a comparison of adjacent orchards, some of which were sprayed and others not. In fact, it is almost the universal testimony of those who have fully tested the matter, or have given it close observation, that a judicious use of the best approved sprays, according to the formulæ and directions printed in THE IRRIGATION AGE last winter, has yielded returns many times greater than the outlays. Every farmer who has a few fruit trees, as all farmers should have, and every one who devotes himself exclusively to fruit growing, should get and carefully preserve THE IRRIGATION AGE for that month of the present year. It contains matter of great value.

Manufacture the Products at Home.—A good motto for farmers, especially in districts remote from the great markets of the country, is: Raise cattle, swine, horses, mules, sheep and poultry enough to consume all grain and forage produced on the farm. In other words, let the products of the farm be manufactured on the farm, and then let the manufactured product *walk* to market. It should be remembered that with every bushel of grain, or every ton of hay sent away from the farm in its raw state, an appreciable amount of nitrogen, potash, phosphoric acid and other valuable ingredients is permanently removed from the soil, and must be replaced or the soil will soon cease to yield returns adequate to the labor expended upon it. By returning a large percentage of the manurial elements to the soil in feeding stock upon the farm, the fertility of the land may be indefinitely prolonged, and the farmer realize the results of being at once a producer of raw material and a manufacturer of it. To illustrate the converse of this proposition, take the case of the cotton planter in the southern States. Every year the land under cotton is being deprived of its fertile elements which are sent across the sea in the form of raw cotton fiber. The producer is compelled to replace this loss by expensive commercial manures and as a result becomes poorer each year in the direct ratio of his acreage in cotton and the size of his guano bill. To put the whole truth in a word, a one-crop farmer is almost always a poor man, and a one-crop country a poor country. Diversity of crops and the manufacture of raw material on the farm through feeding stock is the best farm policy.

"Lightning has Struck the Horse" is perhaps a short way to a long story. Electrical power has been so largely utilized in hauling street cars and performing other tasks formerly performed by horses that a rapid decline in the value of horse flesh has been already noted, and will doubtless continue. The time is very fast approaching if it is not already here when the ordinary all-round cheap "plug" horse will become extinct. Such stock will soon cease to pay its way, and must retire to the oleo factory, the canning establishment or the fertilizer factory. It therefore behooves farmers everywhere to be alert, and adjust themselves to the new conditions which are everywhere taking place, due to the advent of electricity among the cheap, practical and permanent forces which move our civilization to higher planes with each recurring decade. Horse breeders should take due note, too, of the inroads which the bicycle is making upon their business. So popular has become the light, rapid, safe and non-consuming wheel, that the saddle and buggy horse is rapidly losing his job in many places.

Still we must continue to need good draft animals for the plow on the farm and the truck in the city. The family carriage may sometimes be propelled by power drawn from the clouds, but the city street and the country road must undergo great changes before such means of transit shall have become common. In

view of the pending revolution in this direction, then, the best advice to farmers is to commence at once a weeding process, and dispose of all but the best horses, that is, the best for the purposes to which their energies are to be applied. As said elsewhere about cattle, it costs little if any more to keep a well-bred horse fully adapted to required conditions than to keep a scrub of little value.

Irrigation and Fruit Shrinkage.—We learn from a coast paper that a California fruit company has been investigating the effect of irrigation on fruit as regards its shrinkage when it is dried. They found rather unexpectedly that the irrigated fruit had less shrinkage, and was therefore worth more in its green state than fruit grown without irrigation. The conclusion is that the greater amount of water in the soil enabled the roots to take up more mineral matter. It also made a more vigorous growth of leaves, and through these the air contributed a greater proportion of saccharine pulp than was possible with the poorer foliage on trees that had a deficient supply of water.

Propagation of Plants by Cuttings.—The lover of plants would often increase her (or his) stock of a favorite plant but for supposed difficulty of propagation. The jessamine is among this class. A California woman, says the *Santa Clara Valley*, conceived the idea of splitting the end of a slip of a *Tecoma jasminoides* and inserting a grain of wheat. It grew readily. Another took a slip of the mandevillea, which is usually propagated by layering, nicked in several places the bark about the joint nearest the downward end, planted it in the sand, and it readily grew.

Still another had a rare clematis given her, with one-eighth of an inch of stem embracing a joint on two leaves. She carefully nicked the bark on one side of the joint and buried the whole joint, leaving nothing above ground but the few little leaves, and over this turned a glass that fitted tightly about it. The sand was kept moist, and in a short time she was rewarded for her care by seeing new, tender leaves springing up from a young, healthy shoot.

The proper time to propagate any plant from cuttings is when the stem is growing, as evidenced by the putting out of fresh shoots. If propagation is attempted during the dormant season, the cuttings will remain dormant likewise until the new growth starts, or may die while waiting.

Apples All the Year Around.—Professor Craig of the Ottawa experiment station says of the cold storage system: "Before long you will see a revolution in the apple trade. Winter apples will not be a necessity. Cold storage will solve the difficulty. Probably before two years are over you will see in every fruit-growing district cold storage houses on the coöperative plan, based on the cold storage building at the World's Fair. Fall apples put into cold storage buildings where the temperature is 34 degrees may be kept an indefinite length of time. Thus winter apples will not be necessary. When I was at the World's Fair in the middle of the hot season I saw in good condition Duchess of Oldenburg apples which had been ripened early the previous summer and kept in cold storage. While in Montreal recently I noticed in the new cold storage building beautiful California pears." Perhaps! But, professor, how about the superior quality, to the taste of many people, of some varieties of winter apples?

Switch Grass.—F. Lamsom Scribner, the grass expert of the United States Department of Agriculture, contributes this interesting note on the native grass known as Western Red Top, False Red Top, Tall Prairie grass and Black Bent, in different localities:

"*Panicum virgatum*, L., Switch grass, is a tall growing leafy perennial, with strong creeping rootstocks and widely-spreading bushy panicles, bearing small grains somewhat larger than pin heads. The panicles and often the leaves and stems are inclined to be somewhat purplish in color. This grass is a native, ranging from the Atlantic coast to the Rocky mountains, and grows commonly upon somewhat moist, rocky or sandy soil, although it may be found on rich heavy land; and in some parts of the West and in Kansas it has been successfully cultivated for hay. The chemical analyses made of it do not show it to possess high nutritive qualities; still it is considered a very valuable species in the western hay meadows. It furnishes a large bulk of the "native" hay of these meadows and is well spoken of by stockmen. It should be cut when young, for, if allowed to stand too long, it becomes harsh, woody and unpalatable. From its strong, creeping rootstock it would doubtless be a good plant for binding drifting sands, for preventing the breaking down or washing of railroad embankments, etc."

Drouth-Proof Fodder Plants.—The Idaho experiment station recommends the following: "Of the true grasses, Hungarian brome grass, Italian rye grasses, English rye grasses, meadow oat grass, Sheep's Fescue. These all grow well and are not affected by drouth. How they will stand a pasture test is a question not yet solved. Alfalfa does well. Red clover sown in the fall has a fair growth, but is not equal to half the growth of spring sown alfalfa. Sanfoin is a promising plant and grows rapidly throughout the dryest weather. Its nutritive value is not yet determined. Lupine, the great German forage plant for sheep, is not a success, not producing as much forage as our wild lupine." The Idaho station is, unfortunately, situated in the hill country where little irrigation is practiced and where they have eighteen to twenty-four inches of rainfall.

Irrigation Experiments Needed.—Although irrigation is so old an art, there is great need of more accurate knowledge of the proper use of water. Where water is scarce, the proper times for application, and the minimum amounts necessary for the different crops, should be known to a nicety. Where it is plentiful, as in the Yakima valley, Washington, you want to know the amounts and times for application to produce the greatest crops of finest quality. Is a fall and winter soaking of the soil a really advantageous system, as some of the Utah irrigators claim? Where the canals are supplied with cold mountain water, what is the proper course to pursue in the first applications of the season? Does an excess of water cause a softening of texture in fruits? What varieties are best for these peculiar conditions? These and many other strictly agricultural questions, exclusive of the engineering problems, afford a rich and important field for the experimenters at the western agricultural colleges, especially those in the

States of the arid region. Yet some of the professors in the colleges themselves admit that their institutions seem more inclined to follow the lines of investigation and the methods of the eastern colleges and experiment stations, where irrigation is more an abstract interest than a vital question as in Western agriculture. Happily for Washington, it is proposed to establish a special experiment station, as a branch of the State Agricultural College, in the arid belt, where irrigation experiments shall be foremost.—*E. H. Libby in American Agriculturist.*

Farmers' Institutes.—The custom of holding farmers' institutes in winter is a wise one, and we hope that every Western State and Territory will, this winter, follow the example of the older States. A little circular sent out by the Kansas Agricultural College has the following timely remarks on the subject:

"The season for institutes is at hand. Are you prepared to make the most of it? The popular name, 'farmers' institute,' denotes an organization holding meetings for the mutual enlightenment of the members in the business of farming. Is there such an organization in your neighborhood? If not, why not? There is no other object of so much general interest to the people in any neighborhood. There is no other subject in the discussion of which all can join with so much unanimity of feeling, and in which all can take part and contribute from their experience to the general fund of information; there is no other interest which, if the proper feeling exists, can draw the families together in so large numbers, for mutual enjoyment and edification; and if rightly conducted, nothing else, not excepting the farm paper, will be so effective in promoting good farming and good neighborly feeling. An institution with such possibilities ought not to languish. If for any reason no institute has as yet been organized in your neighborhood, you will receive the thanks and appreciative help of your neighbors and friends if you take the initiative in starting one."

Ancient Prices of Sugar.—In these days when the world's production of sugar reaches the annual amount of about seven million tons, of which the United States consumes nearly one-third, and when a hundred pounds of good sugar may be bought for $4, it is of interest to note the prices in previous centuries. According to Herr Von Lippman, sugar was more than forty times as dear 640 years ago in England as it is now. In the year 1300 sugar in England cost about $2 a pound; in 1400 about $2.25; in 1500 about 50 cts.; in 1600 about 75 cts.; in 1700 about 50 cts.; in 1800 about 35 cts.

In view of the enormous prices that our ancestors paid for one of the least expensive food products of to-day, a simple arithmetical calculation may be of interest. If we assume that sugar is intrinsically worth as much now as it was in 1372, the value of the sugar imported into the United States during the last fiscal year would be nearly twenty-three billion dollars—a sum more than three times as great as all the gold, silver and paper money in the world to-day. What was to the people of a few hundred years ago an almost unattainable luxury, is with us a common household necessity. What the princes of the elder world were unable to buy, except sparingly, the poorest American laborer may enjoy in plenty.

The history of sugar making shows that whenever and wherever it has been made on a large scale, evenin the earlier times when appliances were crude, the regions producing the raw material as well as those manufacturing and refining it, have prospered. The enormous consumption of sugar in the United States and the immense territory adapted to cane and beet culture point unmistakably to the day, not far distant, when our home supply of sugar will be produced in our own country. It is a most astonishing fact, not comforting to thorough Americans, that we annually send abroad to buy sugar, gold or its equivalent equal in amount to more than four times the annual production of that metal in the United States. These are facts to be pondered by progressive men who prefer to introduce business into politics rather than politics into business.

Cultivation vs. Irrigation.—Some months ago an article appeared in these columns, written by Mr. Fitzsimmons, treating of the question of more and better cultivation of orchards and less irrigation. His argument is strongly corroborated in the case of some orchards near Denver, Colorado, belonging to the Stark Brothers. An eye-witness testifies that the large orchards referred to are in a region where irrigation is almost wholly depended upon to produce crops of all kinds, and yet these trees have been brought to bearing age and condition and produce abundantly without any irrigation whatever. It is there a mere matter of care and proper cultivation. It has been proven over and over again that a proper and thorough system of cultivation may be made to go very far to supplement a light rainfall, and yield the most valuable results, with the use of a small amount of irrigating water. These magnificent orchards of the Stark Brothers stand as a most valuable object-lesson showing what may be accomplished under a scanty rainfall, by taking the necessary steps to conserve the water which does fall, and to utilize it with the best advantage in the promotion of growth in both trees and fruit. Keep the earth finely pulverized in the orchard to a depth of two or three inches, and allow no weeds to grow, and the results will be surprising, even with a minimum amount of irrigating water.

A Beautiful Hedge Plant.—The mild, uniform winters of the irrigated valleys of the inter-mountain regions are favorable to the successful use of many of the half-hardy trees, shrubs and herbaceous plants, especially in those valleys of low altitude in the northern section, and in all of those of the farther south. As the needed fence laws are gradually being put in operation in State after State, the barbaric fence around smaller places is being found useless, yet the desire for seclusion often calls for at least an ornamental hedge. For this purpose, and to replace the ugly cypress, we indorse the Pomona *Progress* in its advocacy of the Japanese honeysuckle. A rude framework or wire fencing must be provided on which to train it. It has long, flexible branches, terminated by the fragrant blossoms, red outside, nearly white within. Plant from three to six feet apart and weave the branches as they grow in and out among the larger ones. It will soon cover the fence, and blooms profusely in June. Another variety, the *Lonicera fragrantissima*, is a winter bloomer, is evergreen and the most fragrant of all honeysuckles. It is an erect shrub and grows to a height of six feet. There are about eighty species of honeysuckle, and many of them are desirable for hedge purposes.

Growing Blackberries.—The essentials of successful blackberry culture are high fertilization, thorough tillage, judicious pruning and heavy mulching, says a writer in the *Industrial American*. The blackberry in its native hedge row is annually mulched heavily by decaying vegetation. The soil about the roots is always loose and open, and the finest berries are on canes that grow in some spring run where one needs rubber boots to get them. Native varieties bear berries one-fourth to one and one-half inches in length, on canes six to eight feet high. Transplanted to the garden they fail to grow and change their character entirely. I believe their rampant growth to be due to a soil exceedingly rich in vegetable mold, and to the unfailing supply of fresh clean water that spring runs furnish. It is not stagnant water that sours the soil, but a constantly changing supply of sweet spring water that seems to be the blackberry's special delight.

Give the plants high cultivation early in the season and a heavy mulch as soon as hot, dry weather comes on. Use bone and potash in some convenient form pretty liberally at the start, and the heavy mulch supplied annually will supply the rest as soon as it decays. Pinch out the tips of the young canes when from three to four feet high, thus forcing them to branch and incidentally to more thoroughly ripen their wood. If the plants have many side branches it may be well enough to thin them a little, or possibly it may do to cut back the ends of a few buds, but I had rather take my chances for a crop from an unpruned plantation than from one cut back by one who was not an expert.

Sorghum Syrup by Irrigation.—The eighty and ninety gallon crops of syrup realized by Minnesota and Mississippi valley sorghum growers is laughed at by the Central Washington farmers who have been engaged in the attractive industry but a year or two. One Yakima valley farmer who last fall had a nice field of the sweet stuff reports a yield of 200 gallons per acre, which sold readily in the local market at 60 to 80 cents per gallon. Another grower made 300 gallons on two acres, which he says is much more than he produced on his former farm in Iowa. It sold at 70 cents in the home market.

Eggs in Winter.—With the high winter prices for eggs in all the arid region, and often a scarcity so great that eastern eggs are shipped out to the coast by carloads, the increase in the poultry industry on the irrigated small farms is a natural and healthy development. E. H. Davis, in *Poultry Monthly*, tells how he solves the problem of winter eggs, as follows:

Years ago the poultry business was not as lucrative as now. During winter, although our poultry was well sheltered and fed and great care used to keep the buildings clean, giving plenty of fresh water, air, etc., we found in spring that cost of grain, scraps, potatoes, etc., far exceeded the income from eggs, with labor thrown away.

Now feed cut green bones in fair quantity every other day, and some of the time every day. They are inexpensive, and with a good bone cutter they make, when cut fresh every day, so nice a food that we can only liken it to a nice rare steak to a hungry man. The fowls thrive and the chickens grow rapidly. The mineral part of this food gives chickens material for their growing bones and for the laying hens the shells, while the meat, gristle and juices in these green bones gives material for flesh to the growing chickens and for the interior of the egg.

So now our fowls, instead of being over-fat in winter, are giving us eggs. Instead of being a sorry looking, dejected, unprofitable lot during the molting period, they are wide awake and strong, and many of them go so far as to give us eggs regularly at this time. The grain bill being largely reduced, the egg yield being increased, with no loss from sickness, all aid in making our winter and spring record very encouraging, and no one could induce us to neglect the feeding of green bones freshly cut at all seasons of the year.

The Winter Apple.—The record of the fruits of the irrigated orchards of the far West in eastern markets during the past few years, especially of the apple, together with the falling off in the eastern crop, are proof enough of the assuree future of arid land fruits. For some years to come the palm must be yielded to California for system and business-like methods from seed to table, and to her likewise for adaptability for many of the more tender species which, however, she may in time have to share with Arizona and New Mexico. But the standard fruits, such as the late peach, late pears and winter apples, may be grown of much higher quality in any of the colder valleys of the interior, because high quality in tree fruits is only obtainable in localities where the winters are cold enough to harden and thoroughly mature the wood. Therefore the winter apples of eastern Washington, eastern Oregon, Idaho and Montana, though small in total amount as yet, have already acquired a reputation of the highest. We believe that in the winter apple, for many years to come, lies the proper cash crop of the properly diversified farm of all the northwestern irrigated valleys. So enthusiastic are some of the papers of that region over the prospect that they are apt to overdo the matter, but it does no harm to quote one of them: "The fruit of Hood river, the one that is to make her famous as well as prosperous, is the winter apple. That can be kept. It can be gathered leisurely, once in bearing, bring better and steadier returns and at the very least outlay. John Sweeny's orchard last year, its first year of bearing, produced more net money than would or could have been derived from the same area of land sown to wheat in thirty-six years. This year it should yield fifty times as much, next year seventy times as much, and then for twenty years 100 times as much. In other words, one acre of winter apples is worth more, year in and year out, than a hundred acres of wheat. Six acres of good orchard will yield a larger net yield than a section of wheat land. Multiply the acres in Hood river valley by 100 and some idea of the wealth that it will eventually produce may be gained. In other words, every section in fruit will produce a cash value equal to three townships of wheat. The winter apple is going to accomplish this result. And the next few years, as the young orchards come into bearing, will prove the truth of this assertion, though it now seems a wild one. We can but reiterate our former words: 'Plant apple trees; twenty acres if you can, one tree if that is your limit, but plant at every opportunity.' When this valley is an orchard, from the mills to the summit east of us and from the river back for twenty miles, then only will it have attained its full development."

Keeping Sweet Potatoes in Winter.—W. F. Massey, of the North Carolina experiment station, thus describes how to keep sweet potatoes in perfect order until June: Procure a good supply of pine straw from the woods in a dry time, and keep it under cover ready for use. Dig the potatoes as soon as frost cuts the vines. If not convenient to dig at once, cut the frosted vines off at once, or they will harbor fungus growth that will damage the potatoes. Dig on a warm, sunny day—lay the potatoes along the rows as dug, and do not allow them to be bruised by throwing into piles. Handle at all times as gentle as eggs. Allow them to lie in the sun during the day, and in the evening haul to a convenient place. Place a good layer, a foot thick, of pine or other straw on the ground, and on this pile the potatoes in steep heaps, not over twenty-five bushels in a pile. Cover the piles thickly all over with the dry pine straw. Now build a rough board shed over the piles, and let them remain until the weather grows colder, or until they have gone through a sweat and dried off. Then cover the heaps with earth six or eight inches thick and beat smooth. The important points are the sweating under the previous cover of the pine straw before covering with earth, very careful handling, and the board cover overhead. Dry earth keeps out more cold than wet earth. If for family use, put in smaller piles and take up an entire heap at once for use, keeping them in a dry, warm place while using.

An Ornamental Fruit.—Tree Tomato of Jamaica: *Solanum betaceum.*—Professor Wickson of the California experiment station describes this species as a native of Central America, grown also in semi-tropical South America and in the Mediterranean region. The plant is of shrubby habit, growing five or six feet high, with large, shining leaves, often a foot long. The flowers are fragrant, of a pale flesh color, with yellow stamens, and are followed by fruit the shape and size of a duck's egg; at first of a purple tint but gradually assuming a warm reddish color as it ripens. When ripe the fruit may be used raw as a tomato is; if the skin is removed and the fruit stewed with sugar it has a slight sub-acid flavor which is very refreshing. Mr. I. H. Cammack, of Los Angeles county, who grows it successfully, trims up his plants to tree form, and with their large glossy leaves and showy fruit they must be very handsome. The plants bear the second year from the seed and the fruit ripens continuously for several months. It is not expected that the fruit will be of any commercial importance, but may be popular for home use, and the plant will be acceptable to all who enjoy striking semi-tropical vegetation. The seeds should be started just as are those of the common tomato and the plants set out eight or ten feet apart.

Rice By Irrigation, is a subject of experiment at the University of California. It was grown last year on moist land without flooding. Where the soil is kept wet by irrigation or by seepage the plant has been found to make satisfactory growth. In growing rice without the use of standing water, weeds must be destroyed by cultivation and hand pulling from the rows. Sow the rice as early as can be done without risk of frost, in drills three or four feet apart if for horse cultivation or two feet apart if to be worked by hand. Keep the soil clear of weeds and as moist as may be feasible.

The Apple Crop.—The apple crop of the United States for 1889, as returned by the census of 1890, was 143,105,689 bushels, against 36,367,747 bushels of peaches and 3,064,375 bushels of pears. But notwithstanding this enormous yield of apples, and in spite, too, of the planting of constantly increasing areas of apple orchards in many parts of the country, there is often a great scarcity of good apples. The remarkable spectacle of a barrel of apples selling at $50 was witnessed in Chicago in the early part of the summer just passed. While such a sale by no means represented the condition of the apple market at the time, yet it emphasized the general scarcity of good apples in the United States, when it would appear the supply should always be adequate to every demand. To the irrigated regions of the Great West must the future look for a full supply of the best apples. An almost unlimited territory may there be found, wherein the soil, climate and other conditions, as altitude, exposure, etc., are eminently adapted to the best possible results in apple culture. It is a well-known fact that a large percentage of the apple orchards of the older States have greatly deteriorated in recent years, and are no longer able to supply the fruit demanded by the American people—the most voracious fruit consumers in the world. As showing the conditions prevailing over a considerable area of our country at the present time, the following views of a prominent dealer in Boston are here given: "The country is rapidly approaching the time when there will be a permanent scarcity of the finest fruit that grows—I mean the apple. The apple orchards in the United States have been allowed to go slowly but surely to ruin, and Lower Canada is now depended upon almost entirely to supply the Atlantic coast market with apples. In northern Michigan there has been a considerable increase in the orchard acreage, but this side of the Alleghany Mountains no apples are now raised that are worthy of the name."

Poland-China Hogs.—The Poland-China is strictly American-bred, and of over forty years' standing. They are a large breed, with strong bone, good feeders, fatten readily at any age, and can be made to dress 300 pounds or more at twelve months old. They have long bodies, short legs, broad, straight backs, and square, heavy hams and shoulders. Color black, with white face and white feet, and occasionally white spots. They have drooping ears and fine style.

The Hen as a Breadwinner.—To boom the poultry business as a bonanza for gathering in the shekels so dear to every one is a cruel wrong. To deprecate the business and dwell on its unfortunate victims is equally wrong. There are hundreds of successful poultry breeders in this country, and there are thousands of unsuccessful ones. It will be ever thus, not only in the poultry business, but in hundreds of other pursuits. Let no man or woman be deluded by rosy promises to expect large revenues from poultry raising, and at the same time let no man or woman with American pluck and sand be frightened at the failure of others. The American hen is a breadwinner, but it takes experience, hard work and common sense to make her shell out her best.—*American Fancier.*

It is possible to make money out of a dairy when you can sell butter at 30 cents.

THE QUESTION BOX.

The Question Box shall be an "open parliament" for the discussion of the practical, every-day questions that perplex the irrigation farmers. Questions will be answered by those men of long experience among our readers who are glad to give of their knowledge for the common good. Further answers are solicited from any reader whose experience differs from that published here. The editors reserve all rights of control of the department.

Cultivation vs. Irrigation.—*J. C. V.*—Some farmers claim that thorough cultivation, and two or three irrigations, during the season is better than more irrigation. (1) Is this true of potatoes? (2) Of what kind of fruits is it true? (3) State approximate number of times for cultivation, and likewise for irrigation in each case. (4) How late should deciduous fruits be irrigated? and (5) how early in spring?

(1) Yes, this is true also of potatoes. But it does not imply heavy irrigation. Potatoes should not be irrigated deeper than half the height of the ridge in which they stand. (2) It is true of all fruits. (3) This depends much on soil and season. In general, I would irrigate about three times, and cultivate as soon after each irrigation as the soil could be worked to prevent baking. If weedy, it might be necessary to cultivate two or three times more. (4) Not later than the formation of winter buds, which will vary with the kind of fruit. (5) When buds begin to swell.—PROF. G. C. GEORGESON, Kans. Ag. College.

There are so many conditions to be taken into account, it is impossible to give an answer to these questions that would answer for different localities and seasons. Both trees and vegetables require irrigation earlier in the season some years than in others, owing to amount of snow or rain during the winter months, and the frequency depends largely on the thoroughness of the work and the cultivation following. (1) (2) (3) My experience in this soil and climate teaches me that in most seasons four thorough irrigations are sufficient for fruit trees, and potatoes require it every two or three weeks, depending to some extent on the weather. Hot winds carry off the moisture very fast. Proper cultivation as soon as the soil is sufficiently dry after each irrigation will save half of the irrigation. (4) A thorough irrigation in the fall as late as can be done, say in November, will save the first spring irrigation and be better for the fact that the moisture will get evenly distributed through the soil where every root-fiber can feed on it. (5) Our first irrigation in the spring is usually in April, and is required as much on the first some years as on the last in other years, so the only answer is, do it when the soil needs it.—C. P. WILCOX, Yakima County, Washington.

METHODS ABOUT GREELEY, COLORADO.

The writer has but little experience in fruit culture, but may say that in this State the rule is to water as late as you can get the water. This keeps the soil cold and prevents buds from starting early. It also prevents the south side of trees from drying up as they are sure to do in warm spells in winter and spring if the earth is dry around the roots. As the soil may dry out during a winter without much snow fall, it is wise after such a winter to apply the water as early as it can be had or got to run, which will vary with the climate. In the immediate vicinity of Greeley we know more about potato culture than orcharding, but before treating of our methods in raising this crop let me say that for small grain and alfalfa, crops that of course are not cultivated after sowing, we regard two good deep irrigations during the season enough and much preferable to a number of light ones. Light irrigations scarcely reach the roots and are evaporated in a few days, while a deep irrigation takes a good part of the water below surface evaporation and supplies through the roots the water needed to carry on the healthy functions of the plants. Of course a portion of a heavy irrigation gets below the reach of the roots and is lost to that crop. However, if the soil immediately below the roots is damp, this dampness will to some extent work up and keep the plants growing and for a time dew will be formed on the leaves at night. As long as this takes place the crop is not suffering. In the case of an old stand of alfalfa it will be a very heavy irrigation that will go below its roots. Still, running on water for, say a week, will injure alfalfa, and keeping it up for two weeks in hot weather has been known to kill it.

We will now give what we consider the best method of cultivating and irrigating a potato crop. Plow deep, nine to ten inches, harrow and level down the day's plowing every evening if the weather is at all dry. If the ground is not moist deep enough so that the soil will turn over mellow, it ought to be irrigated before plowing. This is especially advisable if either manure or alfalfa are to be turned under. We here plant with an Aspinwall planter. This leaves slight ridges over the potatoes. A few days after planting we go over with two-horse cultivator, letting the shovels go about as deep as the plowing. This is to prevent baking of the soil from the walking of four horses and the wheels of planter over surface. Slight ridges are thrown up over the potatoes which are harrowed down about level in the course of about ten days, when the potatoes will be about coming through the ground. This harrowing is best done in a direction diagonal to the rows. Its object is to kill the young weeds and will not injure the potato sprouts. After these are two or three inches up, cultivate again, using fenders to keep the dirt from covering up the young plants too much.

A third cultivation is given without the fenders before the young weeds have got out of the seed leaf. This is followed by deep furrowing out, either with a shovel plow with wings on it or with a lister. This is to prepare for irrigation. In a season of ordinary spring rainfall the crop under this culture will be growing well and the plants beginning to blossom. The water should be run in the furrows between the rows long enough to wet through the ridges, which may be found out by digging in with a shovel. It will take longer to effect this if the rows are steep. Also, if there is not a pretty stiff subsoil under, there is a tendency for the water to go down instead of sidewise under the rows. Such soil is not well-adapted to potato culture.

If the weather is dry within about three days after irrigation, the soil in bottom and sides of the furrows should be slightly disturbed so as to prevent it from forming a crust. This may be done with the same implement that made the furrows, but a tool with small teeth set in a shape to scratch bottom and sides is preferable. One other irrigation will usually be sufficient and if the crop is a good one the plants will be meeting across the rows so that the water will flow slowly and they will shade the ground so as to prevent baking. If you have the water for a third irrigation, it is likely to increase the yield, but two, usually, will make a good crop. DAVID BOYD.

PULSE OF THE IRRIGATION INDUSTRY.

A TYPICAL WESTERN MAN.

NELSON STORY was born of English parentage in Meigs County, Ohio, in 1838. As a boy of nineteen years he taught a district school. Being early impressed with the possibilities awaiting active, intelligent young men in the great West. Reaching Illinois in 1858 we find him later in Nebraska, then in Missouri, and as one of the first wagon trains that ever covered the Smoky Hill route, reaching Denver in 1859. He erected the third mining sluice in Colorado. The following four years were spent in the varied pursuits of miner, merchant and freighter. About this time the richness of the gold deposits in southeastern Idaho (now Montana) began to claim attention, and Mr. Story landed in Bannack with a mule pack outfit on June 3, 1863, twenty hours before the discovery of the richest of all placer deposits, that of Alder Gulch, lying forty-five miles northeast of Bannack. Inside of forty-eight hours our indefatigable rustler was in Alder Gulch, where he remained in the vicinity of what is now Virginia City, Montana, for two years, where by careful attention to business he laid broad and deep the nucleus of his now comfortable fortune. In 1865 he embarked in the cattle business, purchasing 600 head in Texas and bringing them to the Big Horn country, on which range he held them until selling out to the Murphy Cattle Company in 1890. On December 4, 1865, Mr. Story established his residence in Bozeman, Montana, where his home has been until the present. In 1871 he purchased 800 head of horses near Los Angeles, California, bringing them overland to the Yellowstone Valley, where they ranged until disposed of in 1891. Neither time nor space permit the relation of many incidents in this career of Mr. Story which were thrilling in the extreme. Nelson Story is a pioneer of the Pioneers, and has for times almost without number been in positions where his property, his life and that of his family and associates depended solely upon his indomitable courage and sound judgment.

Mr. Story has been actively engaged since entering the State in developing its resources, was the first to engage in commercial milling of flour, and now owns and operates one of the finest milling and elevation plants in the State. He established in 1878 the Gallatin Valley National Bank, which went into voluntary liquidation in 1893, every obligation for the bank having been canceled in full. When the Legislature of 1892 established the State Board of Education Mr. Story was appointed one of its first members from Gallatin county, a position accepted by him solely in the interests of the Agricultural College, which was located at Bozeman, at the same legislative session. In his dual capacity of member of the State Board in charge of the educational institutions of the State, and that of a citizen and taxpayer of the county in which the institution is located, he has been one of its best friends. His early collegiate education and personal experience as a pedagogue has peculiarly fitted him for the position as adviser in mapping out the course to be pursued by the college management. Nor have his services been confined to that which is said to be the easiest to give "advice," but the college enjoys tangible proofs of his esteem in his generous benefactions in the grounds covering twenty acres in an imposing location, almost in the heart of the city of Bozeman, overlooking one of the most extensive and beautiful of the Rocky Mountain Valleys, bounded by three majestic mountain ranges, and in sight of the union of the Gallatin, the Madison and the Jefferson rivers, the true head of the mighty Missouri.

Mr. Story is a man of wonderfully strong convictions, a republican in a State which for many years was rock-ribbed and buttressed with democracy, and a resident of the banner democratic county "old Gallatin," unswerving and unyielding this many years. The campaign of '94 found him actively engaged in the local and State campaign, and perhaps more to his earnest efforts are due the great republican victory achieved in the county and State than to those of any other citizen. Mr. Story has been repeatedly named as a suitable candidate for the lower branch of the Legislature, was nominated for the State senate in 1892, but believing his candidacy might work injury to the interests of the City of Bozeman then enlisted in the race for the State Capital, he withdrew his name, has been urged time and again to accept the gubernatorial nomination, but has always steadfastly refused to enter the political field. His friends, who are legion, believe him to be the logical candidate for the east side for United States Senator and a strong effect is being made to induce him to enter the race. A speech delivered by him during the recent campaign, upon "Silver and the Tariff," has attracted just attention to his perfect ability to champion the cause of "the white metal."

In the prosecution of his large and varied business interests Mr. Story has transacted business from the northern boundary of the United States to the Gulf of Mexico, and from ocean to ocean, has been a great traveler within our country, and is thus peculiarly fitted, from close observation and extensive travel to correctly gauge the business requirements of our country and to intelligently render acceptable service in an official capacity, and not only Montana but the Union would be fortunate to secure the services of one so able to give the varied business interests the attention of which there is such sore need.

TWO IRRIGATION CONVENTIONS.

DURING the month of December two large and important irrigation conventions were held, and it is noticeable that both of them met in cities located east of the Rocky Mountains. This but emphasizes the fact that Semi-Arid America realizes the advantages of irrigation.

The second annual convention of the Nebraska State Irrigation Association held at Kearney was largely attended and was a pronounced success. Among the many prominent people present were Chas. W. Irish, secretary of the office of the Irrigation Inquiry, Washington, D. C., Judge Emery of Hutchinson, Kas., Donald W. Campbell of Denver, Col., President L. S. Deets of the Buffalo County Association, Mayor Brady of Kearney, and I. A. Fort.

In his opening address, President Fort spoke of



FREDERICK S. STOCK,
Of California, Commissioner of the California Water Works and Irrigation Company.

the need of a law which would promote irrigation and at the same time prevent the water supply from falling into the hands of large corporations without proper restrictions by the State. He said that there was sufficient water to irrigate fully three-fourths of the State, either by ditches, pumps or reservoirs.

William Stafford of Julesburg, Colo., gave his experience in irrigating by the use of windmills and reservoirs. He has a reservoir that covers about three-fourths of an acre and during the past season he irrigated eight acres from it. He did not think it would pay to pump water for irrigation purposes if it had to be drawn more than fifty feet.

Hon. W. R. Akers, senator-elect from Scott's Bluff county, advocated the ditch system for field irrigation and strongly urged that the farmers dig their own ditches and own their own water rights.

Hon. Chas. W. Irish made some pertinent remarks in regard to alfalfa, saying that though it is sometimes difficult to get it started, when this is accomplished, it is one of the best crops that a farmer can grow.

The speeches and papers covered a variety of topics and were of an eminently practical nature. The convention was the largest and most successful ever held in Nebraska and awakened a great interest.

I. A. Fort of North Platte was unanimously re-elected president for the ensuing year and the other officers are as follows: Secretary, A. J. Wolfenbarger, Lincoln; Treasurer, James Whitehead, Custer county; Executive board, Martin Gering, Gering; C. R. Savage, Sargent; Isaac Le Dioyt, Hastings; R. B. Howell, Omaha; E. L. King, Culbertson, and a vice-president from each county represented. The next annual convention will be held in Sidney some time late in 1895.

THE TEXAS CONVENTION.

Another successful irrigation convention was that which met in San Antonio, Tex., early in December. Delegates from every part of the great State of Texas were in attendance, as well as many visitors and prominent people. With its usual vim and enthuiiasm Texas has taken hold of the subject of irrigation, and hereafter it will be kept in a prominent position as a matter of great personal interest to every citizen of the largest State in the Union.

The speeches were unusually full and complete and met with an enthusiastic welcome. They covered the subject in nearly all its phases, but particularly from its practical side.

Unfortunately our space is too limited to give even a brief review of the many important matters discussed at this convention, but we hope in our next issue to present them in a fitting manner, including, if possible, short extracts from the many good speeches made.

A SOUTHERN CALIFORNIA EXHIBIT.

An evidence of the substantial prosperity to be attained by a section dependent almost entirely upon irrigation is seen in the display of Southern California products at the Chamber of Commerce in Los Angeles.

It is a unique and beautiful display, the like of which is not to be found anywhere else in the country. The State Board of Trade at San Francisco has a similar display but on a much smaller scale.

The entire second and third stories of a new building 120x120 feet in size on a prominent corner in Los Angeles are given up to the exhibit, the reception rooms and offices of the chamber.

The main exhibit hall is 90x120, and is forty feet high under the great skylight. Broad galleries surround the room, and numerous ante-rooms connect with the display-hall containing special exhibits.

The display is the outgrowth of four years of work and the expenditure of many thousands of dollars. It is visited annually by half a million of people. No admission fee is charged and no advertising of any sort is admitted to the exhibit. Eight hundred merchants and property-owners of Los Angeles and vicinity subscribe one dollar a month toward the maintenance of the display, and this amount together with small rental charges from outside counties for exhibit room pays all expenses.

The display is chiefly made up of the products of irrigation in Southern California, although not a few non-irrigated fruits and vegetables are shown—for there are some sections of Southern California where, owing to the natural moisture of the land, irrigation is not necessary.

The elephant made of walnuts which was shown at the Midwinter Fair, and the huge bottle of wine and the big ear of corn are striking features of the display, which are intended by their size to impress the attention and the memory of the visitor. Choice specimens of fruits of all sorts are shown in hundreds of glass jars preserved in clear liquid. Fresh fruits are shown in their season and large cases of superb dried fruit and rich grain show the excellence and the variety of the products of this favored section.

The Chamber of Commerce of Los Angeles is an exceptionally active and aggressive institution and has done the section which it represents a vast amount of good. Los Angeles is one of the best advertised cities in the country—by which is meant that its good points have been deservedly well presented—and the results show in its steady increase in population and prosperity. For the last six years during which many sections of California have labored under some form of depression, Los Angeles city has steadily gone ahead, and no agency has done more to force that result than its Chamber of Commerce.

THE NORTH PLATTE CANAL.

The North Platte Canal is one of the pioneer irrigation enterprises of Nebraska. It was constructed in 1883 and 1884, and the operation of the canal, and the application of water from it has continued constantly since that time, giving it the oldest and best priority on the North Platte river. For the first five or six years but a limited number of farmers availed themselves of the opportunity of irrigating their lands under it. This was owing to the fact that in those days it was believed that the rain belt would move its western limit westward with such rapid strides that an irrigation ditch in a few years would be useful only as a monument of the folly of its promoters. Continued drouths, repeated crop failures and the explosion of the rain belt theory, has added largely to the usefulness of this canal, and has aroused the people to a realization of the fact that their success depends entirely on irrigation.

This canal is owned by the North Platte Irrigation and Land Company. whose officers are Mr. T. B. Sweet, of Topeka, Kansas, President, and Mr. H. J. Page, of Denver, Colorado, Secretary. The office of the company, at North Platte, Neb., is in charge of Mr. E. F. Seeberger, who has the local management of the canal. Its headgate is located on the south bank of the North Platte river, about twenty-five miles west of the city of North Platte, and the canal runs from thence in an easterly direction for a distance of about twenty-five miles, covering about 40,000 acres of a fine body of land lying between the North and South Platte rivers. The bottom width of the canal at its head is thirty feet, gradually reduced to twenty-four feet in the first two miles, and its carrying depth is five feet. About 12,000 acres of land are now being irrigated from it, and the other lands lying under it are being rapidly prepared for irrigation. The original cost of this enterprise was $30,000, and about $20,000 have since been expended for wing dams in the river and other permanent improvements.

The results of irrigation in this locality can best be obtained from the reports of the farmers under this canal which show that there have been no crop failures and that the yields of crop per acre have been about as follows: Corn, 40 to 70 bushels; wheat, 30 to 40 bushels; oats, 30 to 90 bushels; barley, 40 to 60 bushels; potatoes, 100 to 400 bushels; alfalfa, three cuttings, yielding about six tons annually.

This company sells perpetual water rights of 1.44 second feet for each eighty acres. The land was mostly settled by good farmers from the east, who had no experience in irrigating, and they started with farms ranging from 150 to 320 acres each. Experience now has taught them better and gradually their farms are being cut up into smaller tracts of from forty to eighty acres. Many of the best and most successful farmers under this canal are contentedly making money off tracts of that size, and are extending their operations more in the direction of more intensive farming, than by spreading themselves over larger areas of land.

The Union Pacific Railway parallels the canal, and has five stations and sidings along its line, thus affording the very best facilities for the farmer in shipping his crops and stock.

The opportunities for a man with limited means under this canal are the very best. The soil is unexcelled, the water supply is ample and unfailing, while the chances of obtaining a farm on long terms and easy payments are made extra good, by the fact that the North Platte Land and Water Company which owns a large tract of this land is now offering to sell in parcels to suit on terms that require but a moderate payment down with yearly payments that can be readily spared by the farmer out of a portion of what he realizes from his crops.

The best way to get an irrigated farm of rich bottom land with railroad facilities to-day is to write to E. F. Seeberger, Superintendent, North Platte, Nebraska, or H. J. Page, Secretary, Room 20, Bank Block, Denver, Colorado.

THE EAST RIVERSIDE IRRIGATION DISTRICT.

The East Riverside Irrigation District is situated one half in San Bernardino County and one half in Riverside County, California. The land is of the choicest, and lemons and oranges grow to perfection. The elevation is 1,000 to 1,300 feet above sea level, and a commanding view of the whole San Bernardino Valley is had, while the locality is free from frost.

In 1890 the district was formed under the Wright Act, comprising 3,500 acres.

Since the formation of the district $175,000 of bonds of the district have been sold, the works have been nearly completed, water developed and about 500 acres improved and planted to lemon and orange orchards. Following is a statement of the works and property:

The main water conduit, a 24-inch pipe line, 10 miles long, made of sheet steel coated with asphalt	$120,000
61 acres of artesian water land	30,000
6 artesian wells	10,000
1 receiving reservoir	1,000
4 miles of distribution pipes, office building, flumes, etc.	14,000
Total	$175,000

The whole issue of bonds is $250,000, which leaves $75,000 available for the completion of the water system.

The six wells have been tested and it has been found that by pumping the water from them twenty feet they will furnish a sufficient supply of water for the irrigation of the whole district. The temporary power is derived from a gasoline engine, but it is proposed to employ hydraulic power, by a stream brought from the mountains, for pumping when the system is completed.

This power will cost very little for maintenance, and will reduce the whole system to a gravity plant, and the estimated cost of obtaining the water, piping, and motors complete is $25,000.

Then the district will have $50,000 for the completion of its main laterals and sub-laterals for distribution of the water, as the lands are developed.

It is safe to say that the East Riverside Irrigation District is one of the most successful organizations of its kind in the State of California, and while it is true that the locality possesses great natural wealth and advantages, this success is largely due to a strict and honest adherence to the principles of the Wright Act in the organization and government of the district and to able management of its officers, who are Hon. E. A. Chase, president; W. R. McCully, secretary; Capt. F. C. Finkle, chief engineer; Parrington & Adair, attorneys.

PUMP IRRIGATION NOTES.

It is generally conceded not only in theory, but it is backed up by practical application, that for low heads or for elevations not exceeding 100 feet, the simple form of handling water with Centrifugal Pumps stands at the head.

The San Francisco Tool Company, of Nos. 30 to 32 First street, San Francisco, California, was the first company to give attention to this work, and makes this work a specialty.

In the San Joaquin and Sacramento valleys, particularly in that portion occupied by the Swamp Land Reclamation Districts, centrifugal pumping plants have been used with marked success, and the Company has put in a large number of pumping plants ranging from five to one hundred thousand gallons per minute capacity.

The use of the very large pumps is, naturally, owing to their construction, limited to comparatively low heads, and in no case thus far have any large plants been put in handling water over 30 feet. With the smaller or moderate size centrifugal pumps, 100 feet and even more is not an uncommon matter.

In a recent catalogue, the Tool Company give descriptions and illustrations of some of its recent plants, and it would be well for any one interested to secure a copy. It also contains much of interest on irrigation matters generally.

In Southern California and Arizona, the Tool Company has also installed many large pumping works for irrigation purposes, and it has shown that in many cases it is much cheaper in first cost and operation to put in a pumping plant than to use a gravity system.

This Company has practical data, which shows that in large tracts, and where the lift does not exceed twenty to twenty-five feet, water can be furnished at a cost of fifty cents per acre, including all charge of operating and fixed charges of interest, taxes, depreciation, etc. A copy of their catalogue will be sent upon request.

MAKING AMENDS.

By mistake the article on page 261 of the December number of THE AGE, on the subject, "A Grain for the Arid Regions," was published under the name of our well-known contributor, W. C. Fitzsimmons, though it was from the pen of J. W. Gregory, another contributor who is well known to our readers. The article on the preceding page, entitled "Who Owes the Money?" was also written by Judge Gregory, the second word of the title, as it appeared in THE AGE, being a misprint.

Professor L. G. Carpenter of the State Agricultural College of Colorado, at Fort Collins, has continued the past year the measurements on the amount of the water which returns to the stream after used in irrigation. The results have been much the same as in previous years. This year, in coöperation with the State engineer, measurements were made down the Platte as far as the Nebraska State line.

In the State Agricultural College of Colorado a short course lasting for four weeks is given beginning early in January, and in which lectures are given by various members of the faculty. A series of twelve lectures is given by Professor Carpenter on topics connected with irrigation.

The Larimer County Water Supply and Storage Co., which has used this year for the first time their "Skyline" canal which is at an elevation of nearly 10,000 feet, have decided to keep a man on the canal all winter, and to run such water as they are able to supply their reservoirs and store for the use of the coming season. The company has constructed a low dam at Chambers lake which will hold several feet of water over an area of 113 acres.

The Home Supply Canal is reconstructing their dam on the Big Thompson which was washed out in the freshets of last spring, the engineer being J. H. Nelson who constructed the original dam. It is fifty feet high of masonry, in a narrow gorge, and is used only as a lift dam, not for storage. The contract price is very low.

The second annual meeting of the Inter-State Irrigation Association will be held at El Reno, Okla., beginning Jan. 25, 1895. A very complete program has been prepared and many prominent people will participate. The indications point to a large and successful meeting.

The climate of California has not only attracted the attention of the world, but has wooed many people to take up their residence within the borders of the "land of sunshine" State. Southern California particularly has been the scene of the location of many colonies, and the colony plan is beginning to be recognized as the one method of making homes in Arid America. Of the successful colonies the Tierra Bonita group may be mentioned as among the first. The managers of this group of colonies, Palmer and Chapin, were men well qualified by long years of experience in business and newspaper work, as well as by their honesty and integrity, to carry such an enterprise to successful completion. The fact that they are securing many new settlers and that they have retained the good will and respect of their old ones indicates the high reputation they bear for fulfilling promises. Their Chicago office, 85 Washington street, contains a very nice exhibit of the fruits and other products of Southern California, and they also have many fine photographs of scenes on their land.

P. C. Morgan of Garden City, Kas., lately received a check for $25 from the Aermotor Windmill Company as a reward for raising the most garden truck on a certain piece of ground, drawing water from a deep well and using an Aermotor windmill.

Some gentlemen from Wisconsin have lately been investigating the possibility of successfully raising tobacco in the Salt River Valley in Arizona.

The Texas *Farm and Ranch* says: "The Pecos Valley needs a branch of the agricultural experiment station, totally and eternally divorced from politics, the domination of cliques and subserviency to favorites. Intelligently managed, such a station would save the farmers and fruit growers many costly mistakes, many failures and much dissatisfaction."

The Chino Ranch in California, on which is located the well-known beet sugar factory, recently passed into the control of Mr. C. H. Phillips, of San Luis Obispo. Mr. Gird retains the use of the pasture lands and the home ranch for one year.

The Farmers' Institute of Finney County, Kansas, will hold its next session, beginning January 29. It has the reputation of holding very interesting meetings, and the coming one promises to be even better than usual. Judge J. W. Gregory, D. A. Mims and G. S. Boyd of Garden City, are arranging the program.

Senator Manderson has introduced a bill in the senate granting to the State of Nebraska all the public lands within that territory to be irrigated and reclaimed.

Texas is beginning to realize the advantage of a diversity of crops and the reign of King Cotton is nearly over. In the south-western portion they are turning their attention to raising tobacco.

At the coming session of Nebraska's legislature Irrigation will be one of the chief subjects for consideration. Something in the way of an act, giving the State control of the irrigation canals and providing for the intelligent prosecution of the work, is expected to be enacted. Beet sugar will also be considered, it being the hope of the manufacturers that the bounty will be restored. At the outset of the session an appropriation for the relief of the destitute in the western part of the State will be made.

A Farmers' Institute will be held in Billings, Montana, early in January. It is expected that Professors Foster, Emery, Traphagen and Williams of the Agricultural College will be present.

Great Falls, Montana, has a macaroni factory which cost $5,000.

Gov. McConnell, of Idaho, has taken a good stand on the irrigation question and will probably recommend that something be done at the coming session of the Legislature in regard to it.

The General Electrical Company, which has the contract for conveying electricity from Folsom Dam to Sacramento City, in California, for use for power, light and heat, has sub-let the contract for poles, and work on the line will be commenced very soon. The dam and canal are already completed and the power-house is now being erected.

A Horticultural Society is being organized in Montrose, Colo., and they expect to set aside one day in the new year for the first annual exhibition of the county's products.

The directors of the Tulare Irrigation district in California have fixed the water rates for the coming season as follows: For trees, alfalfa and vines $1.50 per acre for the first irrigation and 50 cents per acre for each subsequent irrigation. For grain and pasture 75 cents per acre for the first irrigation.

The commissioners of Mesa County, Colo., have offered a bounty of $1.00 per ton for sugar beets raised in that county and shipped to the refinery at Lehi, Utah. Experiments with the sugar beet in Uncompahgre valley have been very successful.

Billings, Mont., is trying to secure a woolen mill.

It is expected that an attempt will be made to have the Montana Legislature pass a law giving a bounty on beet sugar manufactured in the State.

Prominent citizens of the Bitter Root Valley, Mont., have recently held a meeting to consider the feasibility of the construction of an irrigating canal to cover the bench lands on the east side of the valley.

Garden City, Kas., announces that it has secured a canning factory.

BOOKS AND MAGAZINES.

A NEAT little book treating an old subject in a new way is "Bread from Stones," translated from the writings of Julius Hensel and other German writers and published by A. J. Tafel, 1011 Arch street, Philadelphia. It covers the subject of fertilization and advocates the use of stone meal or ground stone, in place of the ordinary stable manure or artificial fertilizers, claiming that it is not only cheaper, but better, as the agricultural products grown by its use are not only greater in quantity, but better in quality. In the preface the publisher says: "Is it not sound reason to believe that food yielding plants grown on pure uncontaminated soil will be wholesomer than those grown on soil saturated with sewage and rotten manure from stables?" Price 25 cents.

Wynkoop Kiersted, C. E., is the author of "The Disposal of Sewage," published by John Wiley & Sons, 53 E. Tenth street, New York City. The matter is treated from the standpoint of a practical engineer and placed in concise and compact form before the reader. One of the most interesting chapters is that of the disposal of sewage by irrigation. No attempt is made to disguise the fact that it is not a success. It may be used to advantage by some of the smaller towns, but its great drawback is the necessity of irrigating only at certain intervals, while the sewage must be disposed of at all times. Unless some arrangement can be made to utilize the surplus, the practice is not likely to become general. Price $1.25 postpaid.

In the Law Book Review for the month of November, 1894, is to be found the following review by Chief Justice Hayt, of Colorado, of the Work on Irrigation by Clesson S. Kinney, of Salt Lake City, Utah:

"The author of this work has entered upon a comparatively new field of jurisprudence, and one heretofore unoccupied by any extended work upon the subject. The earlier pages are devoted to a review and description of the methods employed in the past and present in growing crops by irrigation. The chapters devoted to the description of the canals of Egypt, South America, Mexico and Arizona, constructed and operated by prehistoric man, are replete with interest. They furnish an additional evidence of the truth of the adage, 'There is nothing new under the sun.'

"The stupendous system of irrigation of the upper Nile, as the same is reconstructed by the author from the ruins extant, furnish conclusive evidence that engineering as understood at the present time has made no material advance, so far as irrigation is concerned, upon that of the ancients, of whose history we are in ignorance except as the same may be gathered from the ruins of the works constructed by them. These chapters will be of great interest, not only to every student of the law of irrigation, but to many outside of the profession.

"The common law of riparian rights naturally receives the attention of the author in the earlier pages of the book, as it is only by a thorough understanding of this that the reader can comprehend the law as it is established in the arid regions of the west. The leading principles are here given with sufficient fullness to answer the needs of the practitioner, and they are supported by citations to all the leading cases.

"The body of the work, as the title indicates, is devoted to the arid region doctrine. This shows the readiness with which the author states the principles controlling the adjudged cases, and will be the means of saving much valuable time to the profession. In the few instances in which he gives his conclusions upon principle, these are reasoned out with a precision and logic which causes the reader to wish that the author had given his views more frequently instead of resting content with a statement of the views of others, which are often in conflict with one another.

"The chapter on legal remedies, although brief, contains a synopsis of the various remedies that may be resorted to where rights are interfered with. In the concluding chapters of the work the various State and territorial laws upon the subject of irrigation are given in full. These furnish a handy reference to the lawyer and legislator, and will, it is to be hoped, result in bringing the legislation of the various States and territories more in harmony.

"Altogether the work is a valuable treatise upon the law of irrigation, and should be found upon the shelves of every law library in the arid region.

"CHARLES D. HAYT."

Recreation for February will not be behind its predecessors in attractions for the sportsman or the general reader. Prominent in the table of contents will be "The Vulnerable Spot," by Dr. J. N. Hall; "Trouting in Alaska," by Major John Brooke, U. S. A.; "Goat Hunting in the Cascade Mountains," by J. S. Stangroom; "A Bear in Camp," by Prof. F. V. Yeager; "An Episode in a Summer's Outing," by Harvey M. Harper, and the conclusion of President Bates' thrilling story "The Giant Wolf of Bonaplace," all of which will be liberally and beautifully illustrated.

Many interesting items and much useful information will be given in the various departments.

Don't fail to see the February number of *Recreation*. The price is $1 a year or 10 cents a copy. It is published at 216 William street, New York.

RECENT LEGAL DECISIONS.

Some Colorado Cases.—Litigation on water-right issues still continues in Colorado. As the water becomes more valuable, and the pressure for water increases, questions which have been unsettled in the past years now come up for judicial determination. In the District court of Larimer county, Colo., a suit has been heard between the Larimer County Water Supply and Storage Company vs. the Larimer and Weld Irrigation Company, the former company attacking the decree of the latter ditch, asserting that the amount decreed was based on erroneous calculations. If the suit be decided in favor of the plaintiff, it must result in the unsettling of the decrees of many of the other ditches, for it is notorious that the decrees have not represented in many cases either the amount of water needed under the ditches at the time or the carrying capacity of the ditches.

The Larimer County Water Supply and Storage Company have also begun suit against the decree of the North Poudre canal. In this case the decree was a conditional one given before the construction of the ditch. The plaintiffs allege that the conditions were not fulfilled, and that in consequence the order of priority should be changed, making the company of the plaintiff take precedence of the defendant.

Both of the above suits have been heard, but the decisions have not been rendered.

In the case of B. F. Hottel, a mill owner, against the Larimer and Weld canal, the decision of the court was for the defendant. In this case the Larimer and Weld canal was the enlargement and extension of a smaller canal known as No. 10, which was but a few miles in length, and watered a comparatively small area. The Larimer and Weld canal succeeded to the rights of the old No. 10, and it has been the practice during the past few years for the canal to use the water which was decreed to the old water-right owners under the old No. 10, and unused by them, to supply the users further down the ditch, and at times when the water is not needed for irrigation, as in the winter season, to store the same in some of the reservoirs of the defendant company. The plaintiff claimed that the Larimer and Weld canal had no right to do this, and that it was an injury to the plaintiff, inasmuch as its mill-power canal headed below the headgate of the defendant. Several collateral issues were connected with the main question, but on the main question the judge declined to disturb the water-right decrees which have been rendered previously, and in which the plaintiff was a party at the time.

Construction of Deed of Water Rights.—One who conveys land through which a stream flows by a deed which provides that it is intended to and does convey the right to lay a one-inch pipe so as to carry the running water from the stream to certain land of the grantee perpetually and forever, cannot afterward, as the owner of adjoining land through which the stream flows, lay a pipe in the stream which will so divert the water as not to leave sufficient to fill the one-inch pipe of the grantee.

Yocco *v.* Conroy. (Supreme Court of California.) 38 Pac. Rep. 107.

Rights of Owner of Ditch on Another's Land to Alteration and Repair.—The owner of an irrigation ditch has, as against the owner of land through which it runs, the right, in making repairs, to deepen it from one to seventeen inches for a distance of 140 feet, and to gradually lower the bed thereof one foot in a distance of 170 feet, where the object is to make the ditch of a uniform grade and to remove from its bottom local irregularities, and the repairs do not increase the flow of water. Where a complaint alleges a material widening and deepening of an irrigation ditch running through his land, a denial of the allegation, followed by an averment that "on the contrary said ditch is no wider, nor is it any deeper," raises the issue as to whether the ditch has been materially widened or deepened. An easement of the character involved in this case is property, to the reasonable and profitable use and improvement of which due regard being had to the rights of others, the owner is entitled. Bringing the ditch to a uniform grade by removing local inequalities, such as are stated in the findings, is not a deepening of the ditch. The prescriptive right, as to depth, is determined by the grade and general depth of the ditch, and not by local and unimportant irregularities in the bottom of it.

Burris *v.* People's Ditch Co. (Supreme court of California.) 37 Pac. Rep. 922.

NEW COMPANIES.

California.—*Redlands.*—Articles of incorporation have been prepared of the Barton Pipe Line and Water Company. The object of the corporation is to supply water to a tract of land near Redlands, and attend to other matters usually devolving upon such. One thing to be done is the sinking of a system of wells for the safety of the water system. The president of the company is W. A. Nichols; S. A. Grover, secretary; W. J. Melville, zanjero; those and the following are the directors: F. B. O. Kelly, B. G. Burdick, Edward Quinne, W. H. Sargent, Thos. Blakely,

Texas.—*Cristoval.*—The Louisa Mores Irrigation Company has been incorporated by P. H. Mores, Mark Fury and Frederick Mores, for the purpose of constructing dam for irrigation. Capital stock, $100,000.

Laredo.—The Manadas Irrigation Company has been incorporated by J S. Taylor, C. A. Higby and G. N. Howell, for the purpose of constructing canals for irrigation, etc. Capital stock, $10,000.

Washington.—*Waterville.*—The Entiat Improvement Company, incorporated by Frank Ford, A. E. Case, A. L. Rodgers, M. B Howe, to construct and operate irrigating ditches. Capital stock, $8,000.

Tacoma.—Spokane and Lincoln County Land and Development Company, incorporated by Clarence L. Dawson and Isaac B. Moore. Capital stock, $10,000.

D. F. Hostetter of Wauneta, Neb., has completed his reservoir and placed in position a sixteen-foot windmill. He will also build an irrigating plant.

Work on the C. B. Hoffman irrigating plant near Enterprise Kansas, is progressing rapidly.



MY HUSBAND Can't see how you do it.

$60 Kenwood Machine for - $23.00
$50 Arlington Machine for - $19.50
Standard Singers - $8.00, $11.00
$15.00, and 27 other styles. All attachments FREE. We pay freight ship anywhere on 30 days free trial, in any home without asking one cent in advance. Buy from factory. Save agents large profits. Over 100,000 in use. Catalogue and testimonials Free. Write at once. Address (in full), CASH BUYERS' UNION, 158-164 West Van Buren St., B 120, Chicago, Ill.

BONDS FOR SALE.

The East Riverside Irrigation District, of Riverside, California, offers for sale ten, twenty or thirty thousand dollars worth of their district bonds, running twenty years from date of issue, bearing six per cent. per annum, payable semi-annually. A first-class investment.

Correspondence solicited. Address, E. A. Chase, President, Riverside, California.

It is impossible to become an expert farmer without practical experience.

E. J. PYLE, REAL ESTATE AGENT,

303 Main St., Garden City, Kan.

City Residence and Business Property. Stock Ranches and Farms for sale. Irrigable Lands a specialty. Agent for the A., T. & S. F. Railroad Lands. Correspondence solicited.

It is possible for the man who feeds the stock to waste a lot of alfalfa.

It is possible that agricultural colleges may one day be free from political jobbery.

HOME-SEEKERS AND CAPITALISTS, LOOK HERE!

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J. W. GREGORY,
Garden City, Kas.

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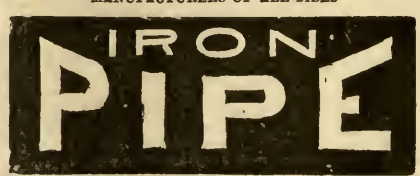
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THE IRRIGATION AGE.

VOL. VIII. CHICAGO, FEBRUARY, 1895. No. 2.

THE PROGRESS OF WESTERN AMERICA.

A Plan of Campaign. We are beginning to see the dawn for irrigation and Arid America. Both in the East and in the West our friends are in the saddle. The opportunity is ripe, and there is much reason to confidently predict that the utmost advantage will be taken of it. The two subjects of interest this month are the plans for an eastern campaign of education and enlistment, and the irrigation bills that are being introduced into the legislatures of eight western states. If only a fair degree of success shall be realized along these two lines, the first three months of 1895 will be the brightest period in the history of irrigation progress. We are beginning to see the fruition of the work that has been done in the past. As for the eastern campaign, that is quite fully explained in another part of this number of THE AGE by extracts from a public circular issued by the chairman of the National Committee. It may be thought that the plan is somewhat audacious. That is not necessarily a fault. On the other hand, it may turn out to be its chief virtue. The man who raises his voice for irrigation and Arid America against the dead wall of national indifference will very quickly learn that he must resort to audacious plans. Meekness has its uses, but it is not of much value in arousing nations to their opportunities and organizing the forces required for continental conquests. The plans outlined in the public circular are the outcome of systematic studies pursued for years in all parts of the country and among all classes of people. They aim both to relieve the immediate pressure and to prepare the way for enduring movements of population.

Utilizing the Unemployed. The plan of using the unemployed labor of the country to construct canals under the Carey law is one that will quickly attract public attention and support. It is a contribution to the solution of a difficulty that is urgent and pressing. Nobody knows the number of the unemployed, nor can any one analyze its character. Not until the lists have been opened to applicants, and the individuals applying have been scrutinized, will it be possible to answer the dozen questions that occur to every mind upon the suggestion of this plan. The writer has talked with all sorts of eastern people during the past few weeks—journalists, statesmen, philanthropists, social reformers, labor leaders—and finds that all concur in the opinion that merely to present this opportunity to the country at this time is an important public service. If the result shall prove that thousands of men now idle are willing to become industrious and productive, then there is absolutely no question about the ability of the arid region to absorb them. They can be furnished with labor first and afterwards with homes. There is little real danger that men who are not willing to work for a chance to live, and finally to become independent, will respond to this call. Those who are idle from choice and vicious by disposition gather by a natural instinct in the purlieus of great cities. They will find nothing to attract them on the voiceless desert. On the other hand, those who are willing to accept an opportunity to work at hard labor, and then create homes on arid lands, are needed in the West. The more that this class responds, the better. It is this class which settled to a large degree the States of the Mississippi Valley. They have made good citizens in the past and will again.

The Colony Home Clubs. But while the portion of the programme which deals with the unemployed will very likely attract the first and largest attention, because it touches a problem which is immediately pressing and carries a certain element of dramatic interest, this is by no means the most important feature of the general plan. There

is room for a vast population in the arid region. It will not be engaged exclusively in agriculture. It will be diffused through the various occupations of a complex civilization. Only a very slight proportion of the population to be ultimately attracted by the opportunities of the West will be drawn from the ranks of the unemployed and the very poor. The great bulk of our new citizenship will come from the fairly prosperous middle classes. We never shall solve the problem of getting population until we have found a way to interest and educate the middle classes of the East and of Europe. We must implant deeply in their souls the desire for better conditions of average prosperity. The second feature of the programme, relating to the organization of Colony Home Clubs, suggests the machinery by which we may begin to make real progress in this direction. The plan is to direct the agitation to the formation of these clubs in all parts of the country. There is no doubt but what tens of thousands of people can be enrolled in time. The only man who is not fertile soil for this part of the propaganda is the man who is satisfied with what he has, or who is too old to undertake to improve his situation. The vast preponderance of wage-earning people live in hopes of something better. They are willing to give a hearing to a movement which deals with new opportunities and new institutions. And a hearing is all that the system of Colony Home Club aims at. To illustrate, supposing one thousand people, mostly heads of families, should be enrolled in a club at Pittsburg. The moment this is accomplished irrigation has a foothold in that great city of toil. A channel has been made and through that channel will be passed a series of attractive books and pamphlets, followed by a series of lectures. Now, this thing cannot be done in the interest of any land company, nor of any state. It can only be done in the interest of enlightenment and human progress. Individuals, companies and States will undoubtedly be benefitted in the end by these new processes, as benefits accrued from the settlement of the Atlantic seaboard, of the Ohio Valley and the Mississippi Basin. But these will be incidental, while progress and enlightenment are the fundamental considerations. The Colony Home Clubs, if they shall be extensively organized and then properly cultivated in the spirit suggested, will become the means of educating the masses to a splendid appreciation of Arid America and its opportunities. This is the way in which real relief will be found for the overpopulation of the East, and real prosperity developed for the vast unsettled regions of the West.

A Word to Timid Souls. It is perhaps necessary to say a word in respect to those timid souls who fear that the development of new enterprises and the inauguration of new movements will have an unfavorable effect on things already under way. Secretary Morton has tried to teach the farmers that irrigation means more competition. In the same spirit those who have undertaken private enterprises have sometimes deprecated further development. This is a narrow view, and views that are narrow are always mistaken. On the theory that to make anything new is a menace to all that existed before, Columbus and all other discoverers, as well as all the inventors and all builders of cities and states, were enemies of the race. And yet these are the men whom the world delights to honor. The truth is that prosperity and depression are great fabrics which cover all communities like a garment. There may be occasional exceptions, but as a rule the railroads, the banks, the stores and the land companies of California, for instance, will prosper when California prospers and suffer when California suffers. The same principle applies to nations and races. The idea of stopping the revolution of the earth until somebody has disposed of his town lots, or unloaded his stocks and bonds, is hardly tenable at this time in the nineteenth century. There is no doubt but what a few men will continue to hold this view while time endures. When they hear the first warning toot of the Angel Gabriel's horn they will petition for a few hours' delay in order to convert their assets into cash. But Gabriel will be like the genius of human destiny. He will keep straight ahead. Everybody is of more consequence than anybody.

Remarkable Conversion of Oregon. The outlook for legislation in western states is better than ever before. The most remarkable awakening is in Oregon. It is largely due to the indefatigable efforts of Chairman F. H. Brigham and his associates on the State Irrigation Commission. Oregon has been popularly known as the "Webfoot State," because of its excessive rainfall. But nearly all its rain falls west of the Cascade Mountains, while two-thirds of the State lies east of the mountains. This part, containing some sixty million acres, is semi-arid. There is a vast domain of public land and the fullest opportunity to utilize the Carey law. Mr. Brigham early enlisted the interest of Governor William P. Lord, and then secured the coöperation of several of the leading lawyers and public men, Senator Dolph among them. The result was the preparation of a measure providing for a State board and for the reclamation of one million acres of land. We have not the details of the matter at hand as we write, but we are advised that the prospect of early and favorable action is very bright. Nothing could be more profoundly encouraging to those who have labored day and night to wake up the West than the conversion of Oregon. Western indifference is giving place to Western enthusiasm, for which we devoutly thank God.



COL. CHAS. L. STEVENSON,
Of Salt Lake City, Utah.

Wyoming and Montana Active. Wyoming has also been foremost in this winter's movements. Irrigation is the most absorbing issue before the present session of the legislature, and a good law is certain to be passed. Wyoming already has a system of administration that is the envy of all other States, and it is a comparatively simple matter to provide for the rest of the programme. This will doubtless be one of the States to receive the earliest benefits of the Carey law. Montana is moving aggressively along the same line. Chairman S. B. Robbins of the State Irrigation Commission continues his tireless effort to push his State to the front. He writes from the capital that a bill has been drafted providing for a State engineer, board of control, and six water divisions, all of which are features of the model Wyoming law. The bill also provides for the formation of districts somewhat like those in California and for a form of public irrigation works. He says that supervision of water companies is also favored. Governor Rickards makes the following allusion to the subject in his message to the legislature:

> The most practical way of dealing with the irrigation question at the present time seems to be the utilization of the provisions of the Carey law. Under this law, the State of Montana may select for reclamation one million acres of government land which the Interior Department will withdraw from settlement under the desert and homestead laws. To provide for the selection of this land and the encouragement of construction companies to build canals, that cheap homes may be prepared for thousands of the unemployed workmen of the east, are, in my judgment, the wisest steps you can take in solving one feature of this vexed problem. To irrigate these lands and sell them at a nominal price, guaranteeing the control of the canals to the people who acquire the lands, after the water rights shall have been paid for, will insure to Montana a substantial increase of population, and lay the foundations for increased revenues to the State. The successful carrying out of this plan might induce Congress to extend further aid in the same direction, and thus convert all desirable portions of the arid belt into a productive domain.

Kansas and Nebraska Attention. In nearly all other states there are gratifying indications of interest. Governor John E. Jones writes from Nevada that irrigation legislation is under consideration and that the State hopes to take large advantage of the Carey law. Chairman Blalock informs us that he has consulted Governor McGraw and other leading officials, that members of the State Commission will appear before the Legislature, and that there is much reason to hope for good results. Idaho is very heavily burdened with silver and senatorships, but there are indications of awakening interest and a fair prospect of action by the Legislature. Our Colorado advices have not reached us in detail, but we receive assurance of growing interest there also. Senator David Boyd, of Greeley, has been made chairman of the committee on irrigation, a post for which he is pre-eminently fitted. This of itself is a very fair guarantee of wise legislation. Kansas and Nebraska are alive and doing their level best to get out from under the ban of the drought. If a joint meeting of the legislatures of these two States could be held on Broadway, in New York, just below Astor Place, we think the result would be a unanimous verdict for irrigation legislation. At this point in the busiest street of the busiest city in the United States a large store front is covered with glaring red letters. Here is an extract: "HELP THE STARVING FARMERS OF KANSAS AND NEBRASKA. THOUSANDS OF PEOPLE WITH NOTHING TO EAT AND NOTHING TO WEAR." How is this for an advertisement of proud old Kansas and Nebraska? Must bleeding Kansas bleed forever, and must her friends wade through her gore on Broadway, just as they do on her own prairies? If there is a spark of patriotism and good sense in the legislatures of these States it can be fanned into a blaze that will bring speedy results this winter.

California Alone Indifferent. Thus far the only State that has not shown satisfactory symptoms of interest in legislative development is California. This seems very odd, but is partially explained by the fact that California is in the throes of a struggle with a giant corporation. After many years of tame submission marked, however, by a growing spirit of protest, the grand old commonwealth has its fingers on the wind-pipe of this monstrous monopoly. Its



JUDGE L. W. SHURTLIFF,
Chairman of the Utah Irrigation Commission.

chief city has exalted the brave Sutro, while a man of the new era stands at the head of the State in the capitol at Sacramento. The work of the *San Francisco Examiner* is bearing fruit, but both that newspaper and its army of followers should remember that there may be other duties which have an equal claim upon their attention. The California legislature assembles only once in two years. There is every reason to anticipate that before 1897 there will be a strong pressure for the opening to settlement of a fraction of the arid public lands. Unless the legislature provides laws under which the Carey act may be turned to some account, the future irrigation development of California will be merely a matter of water and land grabbing under the lax and ill-adapted laws of State and nation. At this very time lands that ought to be in process of wise reclamation and settlement under some form of public supervision are being captured by adventurous speculators. It is worse than folly to permit the precious water supply and valuable lands to be manipulated in a way that seldom brings good to anyone, and frequently harm to all concerned. It is possible for California to introduce a better method to the extent of at least one million acres. It is not too late to accomplish something, and we yet hope that California will wake up to her duty and opportunity.

"Fifty Years Hence."

The New Year's edition of the *San Francisco Chronicle* contained a remarkable symposium on the future of California, entitled "Fifty Years Hence." To a considerable degree these hopeful prophecies apply to the arid region as a whole, and it is worth while to review them briefly in this light. The place of honor is given to an article of extraordinary merit, entitled "Irrigation's Future," by Colonel Wm. Ham. Hall. While the article is in the highest sense imaginative, no one could undertake to say that it is visionary, since Colonel Hall has grounded his hopes on a solid basis of scientific knowledge. He roughly estimates that in 1945 California will have under irrigation 6,500,000 acres, cultivated by 1,600,000 practical irrigators. The census of 1890 shows that California had in that year but 13,732 irrigators. By what method does this audacious prophet justify his hopes of such astounding increase in the resources of irrigation? He has perfectly lucid explanations to offer, applying not merely to California, but equally well to all other parts of Arid America. Of course the basis of his hopes is the complete utilization of the water supply, and the first important development which he predicts in this line is the adoption of flooding as practiced on the Nile. He describes this method at length, showing that it has enabled land to hold its fertility for centuries while supporting a population of 1.2 persons per acre, or a family of six persons to each five acre tract. He thinks this plan of irrigation by inundation will be successfully introduced on the many rivers in the San Joaquin valley. By this method floods that are now disastrous will be utilized, though it may be necessary to allow certain of the lands to lie "fallow," as it were, in alternate years. The adoption of this system would of course involve the construction of basins and levees as in Egypt. Colonel Hall thinks that this will be the next step in the order of development, following the high class irrigation which has thus far claimed the exclusive attention of enterprise in California. He shows the difficulty in the way of utilizing narrow and deep canyons for storage, and says this can only be overcome by building dams from 200 to 300 feet in height. While this cannot be done to-day, he believes it would be a no more wonderful achievement for the next half century than the extension of spans of bridges from less than 700 to over 1,700 feet, and the erection of buildings twenty stories high, have been for the last half century. His further hopes of the extension of the water supply for irrigation may be briefly summarized as follows: 1. By building series of small reservoirs for short-time storage along the foothills by torrential streams, and the application of water for winter flooding. 2. By improvement of works for the diversion and delivery of irrigation waters and the

consequent advance in the administration of systems. 3. By supplanting cobble, gravel, sand and brush dams by substantial works built of non-decaying materials, and thus saving water now wasted. 4. By supplying distribution ditches generally throughout the State with impervious coatings, and by accurately measuring and dividing waters. 5. By the further development of artesian waters and a very great increase in pumping plants, aided by cheap mechanical energy, transmitted by electricity. It is impossible to do justice to Colonel Hall's argument in this brief catalogue of its points, for the article itself occupies twenty columns and every line of it is worth reading. We advise all who are specially interested in the subject to obtain copies of the *Chronicle*.

Col. Hall's Winged Fancy.

Very closely related to the subject of irrigation development is the question of cheap transportation. Colonel Hall considers this factor of such importance that he devotes equal space to it, and it is when he enters upon this part of his subject that his imagination rises to dizzy heights. Much of his predictions as to what is to be accomplished by pumping rests upon his confidence in what electrical technologists will accomplish in obtaining energy direct from coal. He believes that this element is to play a great part in the future of transportation, not only with the railroads, but also with canals. He says the problem of freight transportation in the San Joaquin Valley will be solved by a system of level canals on which boats of 500 tons burden, at least, will be moved in trains by electrical power, operated on schedule time. These trains will pass each other only at locks and no time will be lost in this way, as the delay will be utilized to replenish the supply of electricity. The boats will move at the rate of at least six miles per hour, and freight charges be extremely low. As for passengers, they will skim through the valleys at the rate of 150 miles per hour in a "train" consisting of a single long vehicle, shaped like a cigar. There will be no locomotive. Electricity will drive the car, and we presume it is this same fluid which propelled the Colonel's brain so rapidly through space. He presents us with interviews with the managers and superintendents of the canals and railway systems, so there is no reason to doubt the authenticity of his statements! But while everyone who reads these buoyant prophecies will have his little chuckle about them, they are really not very daring, after all. A Pilgrim Father who should come back from the past and telegraph from Boston to London, then telephone from Boston to Chicago, then cross the continent to San Francisco in six days and stand under the blaze of the electric lights in the grand court of the Palace Hotel, would not be at all surprised if Colonel Hall invited him to sit down and run over the points of his article. The Pilgrim Father would tell the Colonel that his predictions seemed tame when compared with the last century's record of achievement. The fact is, that we live in big and fateful days, and that the human race delights in performing "the impossible." All that Colonel Hall predicted as likely to come to pass in California during the next half century is reasonable. And we shall realize all this, and more, in making the civilization of Arid America.

Other California Hopes.

Other features of the *Chronicle's* symposium are entitled "Outlook of the Truck Farm," "Our Fields of Grain," "Future of our Orchards," "Trade and Commerce," "Wines and Vines of To morrow." We regret that we cannot go fully over the many good points in these articles, which take up for careful review the things already accomplished in these several lines and proceed to erect on this foundation extensive prophecies of what may be done in the future. It is predicted that the business of raising vegetables will assume large proportions when aided by cheaper transportation and better methods of distribution. Practically the same argument is used in dealing with the fruit industry. The writers on both these topics take a hopeful view of the situation and, while they do not predict a return of the old profits of the early day, they expect these lines of business to be permanently prosperous when general business shall have finally been readjusted. Of course Californians have the highest hopes of a wide extension of their ocean commerce, and this is a most reasonable expectation. Mr. George F. Weeks deals with the subject of "Our Fields of Grain," and predicts an enormous expansion of this business, resulting from the reclamation of lands, both from the swamp and the desert, and cheaper methods of production and transportation. He believes California must ultimately prove the world's greatest grain field and be practically secure against competition. In fact, he thinks the demand for this product will be so great that the farmers will sit up nights and plow by electric light. The main value of all these articles is the hopeful tone of the people which they reflect. We are living in a time of general depression and discouragement. It is therefore very reassuring to behold these high hopes of a brilliant future for the Pacific Slope. It is the hopeful, rather than the hopeless, who bear the world forward on strong shoulders, with tireless feet.

The Census Report.

We hope every thoughtful man interested in irrigation will immediately write his congressman for the volume of the census, entitled "Report on Agriculture by Irrigation in the Western Part of the United States." It is the work of Frederick Haynes Newell, the well known hydrographer of the Geological Survey, who was



VIEWS OF THE CANAL BEAR RIVER IRRIGATION CO., UTAH.

special agent in the agricultural department of the census under Mr. John Hyde. The report is a convenient volume of 283 pages, nicely printed and handsomely illustrated. Like everything that comes from Mr. Newell, the work is most conservative in its tone. Portions of it were issued in the form of bulletins as the work progressed, and some criticism was made at the time by residents of states who felt that estimates of values, as well as statistics relating to the number of irrigators and kindred matters, were understated. Very likely such criticism may be heard again. Like all men of scientific attainments, Mr. Newell has a horror of exaggeration, but he has also the scientific respect for facts. He has unquestionably exhausted the resources at his command to get at the actual truth. The scope of the report is indicated in the following list from the table of contents: Number of farms and area irrigated; percentage of land surface irrigated; percentage of number of farms irrigated; percentage of farm area irrigated; character of crops and proportion irrigated; value of land and crops; size of farms; cost of irrigation; total investment and enhanced value; cost of irrigating canals; water supply; duty and value of water; rainfall; artesian wells; reservoirs; methods of conducting water; methods of applying water. This is followed by a detailed statement of irrigation in the eleven arid States and Territories, and the five sub-humid States. The report is therefore a mine of information which should be in the possession of everybody interested in its subject. All the maps and illustrations are well chosen and the diagram showing the rainfall in different portions of the country are particularly striking.

The Weakness of Statistics. The value of a public report of this kind is in the broad generalizations which can be gathered from it. The value does not reside in its details. The broad facts brought out in this volume, are as follows: That of the great domain lying between the 97th meridian and the Pacific Ocean, only four-tenths of 1 per cent. were irrigated in 1890; that all portions of this half of the United States will produce abundantly and support dense populations under proper systems of irrigation and methods of cultivation, the limitation in all cases being the extent of available water supply; that here half a continent remains to be conquered for the human race. It is not for the statistician to deal with institutions, not even to the extent of drawing from history lessons on which to build the hopes of the future. Any man who seeks in this report inspiration for the building of States will seek in vain, beyond the broad generalizations which have already been noted and which stand out as clearly as mountain peaks against the sky. According to the best information which Mr. Newell could obtain from farmers the average value of the products of irrigated lands is $14.89. This was arrived at by dividing the reported value of crops by the number of acres reported to have been irrigated. This was the only method open to Mr. Newell, but of course the result is idiotic. The most conservative farmer in the most conservative community of the arid region would repudiate these figures, and yet Mr. Newell must necessarily accept them because the census machine ground them out. The number of acres irrigated were probably exaggerated as is generally the case, while the value of crops sold, consumed or on hand, was, of course, merely guessed at. The average farmer does not keep elaborate books to show the value of farm products consumed Many of them do not even keep track of what they sell. So we say that in matters of detail relating to economic conditions the public statistician cannot materially assist us. The IRRIGATION AGE has no sympathy with people who advertise that $1,000 per acre can be realized from irrigated land, and it trusts that nobody will be so grossly deceived as to imagine that $14.89 is a fair average of possibilities in this line. Mr. Newell is all right when he has real information to deal with, as in the case of the gauging of the streams. He is properly conservative and cautious in drawing deductions from ascertained facts. But in dealing with details where it is impossible to obtain information of real value he can only give the best he has.

F. H. Newell on California Districts. The California district system has been studied by many impartial minds and it is always interesting to get a fresh light upon it. Mr. Newell devotes considerable attention to the matter, and presents a table showing the amount of land in the various districts with the amount of bonds voted and the amount sold or exchanged. Concerning the effects of this law Mr. Newell says:

> In the five years following the passage of this act upward of forty irrigation districts have been formed or seriously proposed, and the greater number of these have completed their organization and offered bonds for sale. There has been considerable difficulty in disposing of these bonds for cash for various reasons, many of these growing out of the novelty of the matter. At first there was a long struggle in the court before the constitutionality of the act and the amendments were settled beyond question. The main point being triumphantly carried there have been many details requiring exact interpretation and definition by legal decision. Meanwhile, in the practical operations of many of the districts, trouble and unforeseen contingencies have arisen which have tended to render capitalists unusually cautious and unusually timid. The management of affairs of this kind, although in theory not novel, has in operation developed peculiar features. Apparently in each community it should be easy to select men of intelligence to conduct affairs of a municipal corporation, which in many respects the irrigation districts differs a little, but unfortunately the election of district officials has not in many cases brought the best men to the front, and the

consequence of entrusting large affairs in the hands of unskilled men has been too apparent.

One feature of a typical irrigation district in which it differs most widely from other public associations is the fact that it starts at once by attempting to raise an enormous sum of money and to expend it toward the completion of a gigantic project. Little opportunity is given for preliminary work and the acquisition of experience so necessary in all lines of business. In other words, there is not the slow growth often essential for the success of great enterprises. Men are suddenly called upon to supervise the disbursement of hundreds of thousands, or even millions, of dollars, and to take in charge the business of a great corporation, their only preparation being that of a small farmer or professional man in a country town. There are none of the minor rules or precedents so essential to the conduct of the innumerable details of a great business, and the personal judgment of each officer must be constantly exercised. It has thus resulted that both the directors have been accused of extravagance, incompetence and failure to select the best projects, and as a result investors have feared to purchase bonds of certain districts, through doubts as to whether the money would be applied in such manner as to increase the value of the land. It is of course assumed that the land and property of the district in its regular condition is ample security for the bonds, but as a matter of fact the argument is constantly used that the money obtained for sale of bonds will be used in such a manner as to increase this security.

A CAMPAIGN FOR NATIONAL PROSPERITY.

BY THE CHAIRMAN OF THE NATIONAL IRRIGATION COMMITTEE.

The Chairman of the National Irrigation Committee has issued for wide distribution, as a "campaign ocument" in the interest of reclamation and settlement in a broad way, a printed pamphlet entitled, "A ampaign for National Prosperity." It outlines an aggressive plan of work under four heads, two of which re immediately practicable and one ultimately so, the other being purely educational. All are undertaken in the interest of the West as a whole. The first object is to get a hearing for the claims of irrigation. The next is to accomplish actual results. The following extracts furnish a full outline of the document, though presenting less than half of the matter. The complete pamphlet can be obtained by application to the Chicago office of THE IRRIGATION AGE.

A CAMPAIGN FOR NATIONAL PROSPERITY.

Here is a national anomaly. In one half the United States there is a surplus of men and capital, and a dearth of opportunity for the employment of either. In the other half of the United States there is a dearth of men and of capital, and tremendous opportunities for the employment of both. And the country is in the midst of hard times, facing problems full of uncertainty and possibly of peril.

Never in the history of the nation was there graver need of some new and grand impulse in our economic life.

The men of the West believe that past prosperity was due to the policy of peaceful conquest over new areas, and that prosperity can be largely and quickly restored by a renewal of this policy of aggressive national development. They believe they can point to resources that will absorb all idle energies, alike of labor and of capital, rewarding one with a living, and hope of independence, and the other with fair interest. But how shall we *arouse the nation* and *organize opportunity?*

For years I have studied this question from all standpoints and among all classes. And now, in performance of a trust reposed in me by the representatives of twenty-three states, I propose to invite the attention of the American people to three well-defined lines of thought. They are fully set forth in the following pages and briefly noted here:

I.—*Labor and Homes for the Unemployed.*

II.—*The Education of the Masses in the Opportunities for Independence Offered by the Greater West.*

III.—*The Industrial and Social Aspects of Colonial Life on Irrigated Land.*

Some features of this plan will seem at first thought to be of more importance than others, but on full consideration all will be seen to be essential to a symmetrical and enduring development of the national opportunity. It is believed that the irrigation movement, when comprehended, will command the hearty and even enthusiastic support of the people.

WILLIAM E. SMYTHE,
Chairman of the National Irrigation Committee.

1.—LABOR AND HOMES FOR THE UNEMPLOYED.

No accurate statistics are available to indicate the number of men wholly or partially idle to-day. I am advised, however, from the best sources of information that there is practically as much need of employment as there was one year ago. The business depression is certainly as marked, and if there are less acute symptoms of unrest it is because the people have become somewhat benumbed by familiarity with hard times. "Unsettled questions have no pity for the repose of nations." The nation is in the process of readjusting its political and economic conditions, and until patience has done its perfect work there can be no return to permanent good times. Capital can wait. Labor cannot. And idleness is synonymous with danger.

Manifestly the best cure for the laborless is an opportunity to labor, and the best cure for the homeless a chance to earn homes. The Irrigation Propaganda aims to apply this remedy by the simplest and most direct means. There are various movements on foot which seek to make everybody prosperous through the operation of new theories of political economy. The men of the west have no quarrel with those theories, but their method of relieving the pressure of the times is the direct and simple one of putting surplus labor on surplus land. They have no suggestion which promises the privilege of consuming without the trouble of producing. They can offer a living for indefinite thousands, but only in accordance with the divine injunction, "In the sweat of thy face

shalt thou eat bread." There is reason to hope for new and better institutions in the great virgin half-continent. There is the promise of a larger measure of independence and a nearer approach to human equality. There is almost a guarantee of a higher average prosperity for the common people than they have ever realized before in the history of the world. But these things are to be purchased with the old-fashioned coin of honest toil and courageous effort.

THE PEOPLE'S HERITAGE.

The government of the United States, familiarly and lovingly personified in the term Uncle Sam, is the largest land owner in the world. It used to be said that "Uncle Sam is rich enough to give us all a farm." But the extraordinary scenes witnessed during the past few years at the opening of the Oklahoma, Sioux Reservation and the Cherokee Strip reminded the public sharply of two things. First, that public land was becoming scarce. Second, that the demand for land on the part of the people was as fierce and insatiable as ever. Now, the truth is that Uncle Sam is still opulent in the matter of his landed possessions. He is still able to deal generously with those of his children who want farms. He is not able to give them on the old terms of $1.25 per acre, but he is able to furnish a far better quality of farms and a much fairer promise of happiness and prosperity.

Uncle Sam still owns more than half a billion acres of public land in Western America. It is the heritage of the American people. It is perhaps fortunate that it will require the construction of great systems of irrigation to make this land fit for occupation, because in the making of these systems great sums of capital and mighty human energies must be utilized, and that is what is needed to render idle capital productive and thus restore good times. It must not be understood that all of this half billion acres will ever be agricultural land. Most happily, our resources are diversified. The public heritage is part arable, part forest, part pasturage, and a great part bursting with precious metals, with base metals, with marble, onyx and other building stone. It will thus furnish the foundation for a symmetrical industrial life. But agriculture is the foundation of civilization. It was that industry with which the Pilgrim Fathers began in the Massachusetts colonies. The most conservative estimate concedes that this great heritage will sustain at least as many people as now live in the United States, or seventy millions.

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[Here follows a comparison of "the old promised land and the new," with a statement of the advantage of irrigation over rainfall. This is succeeded by a statement of the land laws which have hindered progress in the past. Then follows a description of the Carey Law and the manner in which it is proposed to utilize it in several states.—ED.]

PRACTICAL STEPS TO A GREAT END.

There is no more question about the existence of a large class of unemployed or half-employed than about the existence of the deserts which are awaiting transformation into prosperous homes. But how shall the surplus labor be brought to the surplus lands? This is the broad question. Let it now be stated more in detail. (1) How are the unemployed and others who seek to better their condition to be discovered and organized? (2) How then are they to be transported to the place where labor awaits them? (3) How are they to be supported after they get there? (4) Having completed their labors on the canal and taken up a forty-acre farm under it, how are they to be sustained until they get returns from their crops, and how are they to obtain implements to begin operation? (5) How is the large capital which will be required by construction companies to be raised?

Perhaps it is not possible, and certainly it is not necessary, to answer every question in advance. Probably General Booth was not able to anticipate with a satisfactory answer every question which arose in the minds of doubting Thomases when he entered upon the organization of the Salvation Army. Many another great project, along all lines of human endeavor, has been bravely undertaken in the face of a crying demand for performance, but before it was possible to clearly foresee how each difficulty should be surmounted. Nevertheless, this subject has been carefully considered with men of various classes and is not now undertaken without forethought. Answering the above questions it may be said:

(1) Agitation precedes organization, but in this instance the two operations need not be far apart. It is proposed to inaugurate this movement by great public meetings in New York, Boston and Chicago, followed by meetings in all other important eastern cities. The movement also counts upon the hearty co-operation of the newspapers and magazines, since a cause which seeks to make homes for millions, and to evolve new forms of industry and society, must necessarily be possessed of the deepest human interest. It is also expected that labor organizations will heartily co-operate along this line, since the presence of a large class of unemployed is a constant menace to work and wages. The practical means of enrolling applicants will be to announce places in the leading cities where lists will be opened.

2. The burden of transportation, in case large bodies are organized to go to common points, may be lightened in several ways. Western railroads must be profoundly interested in this movement, as settlement of their tributary territory is their only hope of profitable operation. Already assured of a high degree of interest in these quarters, the projectors of the movement count upon obtaining extraordinary terms for the transportation of homeseekers who may go in large bodies. Furthermore, construction companies can afford to make some advance on wages for this purpose in view of the fact that they are obtaining not only laborers, but also the settlers who are to make their investment profitable. Still further, public contributions of funds may assist. New York City spent $22,000,000 for charity last winter, most of which was expended in a way to make men dependent. Possibly New York and other cities will expend something to assist men on the road to independence.

3. Laborers will be supported after their arrival and during the period of their work on canals by construction companies, which will pay so much a month "and board."

4. The problem of supporting a class which starts without original capital during the period which intervenes between the planting of crops and the harvest is the most serious question in the list. But an answer will be found. By no means all who avail themselves of the opportunity to obtain labor and homes will be penniless. But assuming that there will be many who are, it is entirely feasible to pay men but little cash for their labor, while working for their board on the canals, and to pay the balance in

orders good for seed and provisions. Under this plan each settler would have some capital to start with, and probably be at least as well off as the average of those who settled the Mississippi Valley so rapidly and successfully after the war. As to implements, expensive ones will not be required on these small farms and such as are needed can always be obtained on credit in a new country by well-meaning men.

5. Capital will have to be raised for these enterprises in the same manner that it is raised for others. The class of securities which can be offered, based on the water rights and ultimately on the land, as settlers will secure the construction company by mortgages until the water rights are paid off, will be gilt-edged. If all the settlers should desert and the lands should then be thrown upon the market securities would still be good. The first capital required would probably be advanced in the west and by contractors. Ultimately it would be realized by the sale of securities. The holders of western railroad stocks and bonds ought to furnish a large market for these new securities, since the reclamation and settlement of these lands is absolutely the only hope of making the railroad property profitable. It is estimated that every new family on the line of a western railroad is worth, in what it ships out and in, $350 per year to the traffic of the line. If it shall be proven that there is a real demand for labor and homes and that men cannot have them because there is not money to develop these works, then the American people will indeed be convinced that there is not sufficient circulating medium to meet the needs of the world.

CLASS OF SETTLERS DESIRED.

It is not proposed to accept applicants for this new army of labor without discrimination. But poverty is not alone the proof of lack of manhood. The Pilgrim Fathers were not millionaires. Neither were the men who have made the West what it is to-day, nor has any new country been mainly settled by those who were well enough off before they emigrated. As a rule, those who leave the old home go in search of a better chance. Arid America will receive with open arms every man who in good faith seeks to make a place for himself and is willing to pay for it in the gold coin of hard work. For every such man the imperial West holds a home in trust and stands ready to deliver over the title deed upon proof of good intentions. But by a system that will be outlined at the proper time applicants will be required to furnish information concerning their antecedents and evidence of good faith. In every country there is a class which all communities are anxious to part with and which no community is willing to receive. The gateway of Arid America is broad enough to admit all men who contain the germ of good citizenship, but it is too narrow to willingly admit those in whom this germ is lacking.

II.—COLONY HOME CLUBS TO EXTEND POPULAR INFORMATION CONCERNING WESTERN AMERICA.

This department of "The Campaign of National Prosperity" may not at first thought seem as important as other features. But in the end it will be found a factor equal to any other. * * * * * * Every man who joins a Colony Home Club will have a chance to gain a liberal education as to the opportunities which the new empire offers to industrious and aspiring men. This system of clubs will be conducted something after the manner of the Chautauqua and University Extension systems. They will be popular information clubs. As Chautauqua and University Extension were designed to help those who desire to obtain something of the higher education, so the Colony Home Clubs will be designed to help those who desire to improve their conditions of living.

THE SORT OF MEMBERS DESIRED.

The basis of citizenship in all countries are the great middle class. All efforts should be directed to secure the prosperity of average people. The very rich will take care of themselves. The very poor will generally swarm in the tenement districts of great cities. Society may ameliorate their condition somewhat, may care for them when sick and bury them when they die. It cannot eliminate them as an element, whatever it may do for them as individuals. But the health of our institutions will be truly measured by the condition of that vast preponderance of our citizenship which we describe as the "middle classes," because they are between the poor and the rich. It is from this class that Arid America will draw its best blood during the long future. This class of people is mostly employed to-day. But it is not as prosperous as it can be in the generous West. * * * * * * Now, the material which is desired for the Colony Home Clubs, which it is proposed to form wherever there are industrious men who desire to improve their condition, will be found among these middle classes. All such people will have some capital to start with when they and their neighbors shall hereafter organize into colonies bound for the West.

HOW CLUBS WILL BE ORGANIZED.

The National Irrigation Committee will appoint organizers wherever there is a demand for them, and those organizers will enter the names of all worthy people who apply. Blanks will be furnished for this purpose at the meetings held in the interest of this cause, and also upon application to the National Committee. Clubs may or may not be regularly organized with local offices, as members prefer. The main thing is to have a list of the largest possible number of people who are willing to consider future immigration to Western America, and to have these lists available in connection with plans for courses of lectures and reading.

LITERATURE AND LECTURES.

As rapidly as possible after the organization of these clubs courses of lectures and reading will be developed. These will be furnished members of the club on terms which will enable everybody to take advantage of them. The first effort in this matter will be directed to the provision of cheap pamphlets and books by the best authors. These will deal with such topics as the history of the Mormon industrial system, the story of the Greeley colonists of Colorado, the development of prosperous colonies in California, and a large variety of information about the growing civilization of the West.

[The third division of the pamphlet deals with the subject, "A Typical Colony to Illustrate the Best Possibilities of Industrial and Social Life under Irrigation." This is similar in thought to the editorial statement in THE AGE for December, though fuller in detail. It also describes the experience of colonies in Utah, Colorado and California.—Ed.]

IRRIGATION PRINCIPLES.*

IV. CONTROL—ENTERPRISE.

BY WM. HAM. HALL, MEM. AM. SOC. C. E.

IT MUST not for a moment be thought by those who may read these papers that they are written with any idea of attack upon rights which have accrued under existing laws in our irrigation states of the arid region and Pacific Coast. Rights, whether of property or of use, depending either upon riparian ownership or water appropriation, are fixed in California, for instance, and no general criticism of the system on which they are founded will in the least affect them, or harm the interest of those who hold them. But if by analysis of that system and review of its working we can get at some fundamental reasons for the train of disappointments and failures which is now found in the wake of irrigation progress, we may do a service without inflicting a damage. We may help to prevent newer irrigation states and territories from going as far wrong, to their grave injury, as several of the older ones have gone in this field of development. We may succeed in impressing on those who assume to lead and control irrigation sentiment and legislation in the older irrigation states, some points in which their leadership might be bettered; and, as the best thing which can happen to men is an awakening to the fact that they are not infallible, every contribution to that end should be graciously received by the individuals, as well as the people whose interests have been so far injured by unwise leadership. Moreover, we may rouse some people who are putting or have put their millions into irrigation works and properties, to the knowledge of the fact that there are yet other mistakes in the field than those whose realization has already been forced upon them by the courts and otherwise. And if we accomplish this latter object without giving offense, we might hope to point out to these commendably enterprising investors a course of policy along which they may escape from or modify retarding influences now hampering irrigation growth, and avoid others which may develop with time.

It sometimes, in the course of human progress, is instructive and even practically beneficial to get down from horseback and walk, in order that we may better appreciate the condition of the road and realize the application of those fundamental principles upon which it should be built and kept in repair; especially, if we aspire to the office of road overseer. Albeit the principles of road making and maintenance are very simple. But then everybody can not be thought to have been born with an understanding of them, or to have subsequently mastered them, or even studied the subject. Especially so, in the cases of those who have spent their lives industriously and vigorously in other walks of life.

To drop the allegory and take up a practical illustration suggested by it: There has been a class of specialists—civil engineers—preaching the present popular "good roads" doctrine for a half-century back, but with a scant attention from the general public or those who have assumed to control road legislation and management. Think how long under such circumstances our great country has suffered and its progress been retarded by bad road laws and administration and bad roads. Yet road building is an engineering art, and the economic problems of roadways are engineering questions. Then realize the immense awakening there has so lately come, as though it were a new revelation, all over the land and among people of all classes, to the omissions and mistakes made in this everyday kind of development, which is simplicity itself compared to that of irrigation, as an economic problem. Finally, reflect that road reform was hindered, prevented, lo, these long years, by the opposition of those to whose benefit it would most inure—farmers and farming land owners. And when we have realized the picture we should not be stampeded or put on the defensive by an invitation from a lifelong professional friend of irrigation development to study dispassionately the errors of its ways; for the sooner these errors are known and eliminated the earlier the great irrigation industry will gain the widespread public confidence it should command; and the quicker will enterprise, founded upon it, reap that return to which it is entitled.

As a matter of fact, irrigation development in America has been along lines laid for it chiefly by those who had neither experience, broad observation, nor special reading to guide them. Unfortunately, it has been marshalled as if the problems were new to mankind, and leadership needed a prophet or inventor, rather than a student of the practical lessons of development in other lands. In our ignorance on this subject and our pride as a people we have turned our backs on what we might have learned from other countries, of irrigation organization, enterprise and economic industry. Some of those who have assumed to lead in irrigation legislation, and, unfortunately as it turns out, those who were hearkened to, have not led, but weakly trimmed their measures to catch legislative votes enough to pass them—subjecting what was clearly right to what was apparently politic. The country has caught the result. Others, who have stepped to the front in speculative enterprise, and, in so doing, set captivating examples, have been short-sighted in their forms of organization as affecting the economic and social problems involved. Especially is this the case in the relation sought to be established between development enterprise and irrigation under it. It is not too late to correct some of these mistakes. And for this purpose, let us first see how the application of fundamental principles may affect class interests, as well as the general interest.

And still again, on another point it is well to guard against possible misunderstanding. In speaking herein of the mistakes of irrigation enterprise and the unfortunate condition of its development, in some aspects, in this country, the writer implies no criticism on irrigation industry itself, but he calls attention to some faults and foibles of that class of enterprise which prepares the way for irrigation—the construction and management of works and the establishment of those business and politico-social relations under which people are solicited to come and settle and become irrigators. However much irrigation practice has succeeded, however gratifying and even wonderful its results in transforming arid

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lands into beautiful fields and orchards, there is no use attempting to conceal the fact that the business of irrigation development, as distinct from irrigation itself, and by whatever form of enterprise attempted, has, as a whole, in this country, thus far proved unremunerative, and quite frequently disastrous. It may be said that the reason is found in the wave of general depression in all business, which overtook this industry just as it might have resulted differently. In some cases, doubtless, this is so; as a rule, the writer maintains, it is not. The prevailing disappointment in irrigation enterprise and investment is broadly attributable to defective irrigation laws, and bad organization and management and scamp engineering under them. Irrigation itself has been triumphant. With those to whom these articles may have special interest, it needs no vindication nor upholding. And, for the general public, its praises are now being well spread throughout the country by the facile pens of able and popular writers. But why are investors in irrigation works and securities disappointed, by and large? This is the question. Let us get down and walk and examine the road and the foundations on which it is builded.

RIGHTS, ASSOCIATION AND CONTROL.

The ownership of water in common by the people, the association of people, locally, to promote the use of and manage the distribution of water, and the supervision, broadly, by the state, of sources and courses holding community waters, and of diversions therefrom, as I have in a former article shown, are fundamentally accompanying parts of all civil law water systems. Because under the common law waters are not a common property of the people, the idea of communal association for their local use does not follow as a logical sequence; and for this and other reasons heretofore given, state or governmental supervision of streams and diversions, is generally, in common law countries, at first thought to be not only unnecessary, but unjust interference with the privileges of riparian proprietors and appropriation water-right holders.

It does not follow, however, in these common law countries, where water is a public thing, subject to taking by any who may have access to it, that association for local promotion and control of its use is not equally desirable and necessary as where the fundamental principle of its ownership directly suggests such organization. Nor does there appear to be any point in the common law which might conflict with such community associations as exist for this purpose in countries under civil law. Nevertheless, during the earlier stages of development of countries which have adopted the common law there seems invariably to have been a very active opposition to the introduction of those forms of organization. Apparently this is due to the prejudice of large land owners, the selfishness of men who seek to profit in private enterprise to the exclusion of community effort, and the public's lack of experience of such communal association.

Precisely the same may be said of state supervision. Under the common law status of water ownership the conclusion does not follow, logically, as a part of a line of reasoning, that the state must maintain an administration of streams and water diversions therefrom. The fundamental starting point—the people's community of property in water separate from streams—does not exist.

But though this reason is absent, there is an equal, if not greater necessity, in the public interest, for both, "association" and "control," as respects irrigation, under the common law rule. If water is practically that class of property, like birds and wild beasts whose ownership is in no one until surrounded and captured—fenced in and "preserved," as it were, by riparian proprietors—or diverted and "bagged," so to speak, by appropriators—then is there all the more necessity for those persons who must use water in irrigation, but who cannot individually compass the end of supplying if, associating themselves together for that purpose—to join in the chase—to do some capturing, as it were, for themselves—or, more plainly, become appropriators, collectively, on their own account. And, if this is the basis we are to go on—if water is practically *res nullius*, the property of no one, like the wild beast or bird to be hunted or trapped by rival huntsmen, called by the law "appropriators," then in place of the beneficent supervision of the people's common property by the administration of streams, we must have a police of waters, a control to prevent these eager (naturally and commendably enterprising) huntsmen from coming in conflict, to the public detriment, or unnecessarily or wantonly killing the game, as it were.

For, this water beast is a curious thing; it keeps on running after it is caught. It is a long-drawn-out animal, whose possession is never quite in hand. It must continue to run at large in the public stream, yearly to re-enter its captor's trap. Even though once caught and identified, it cannot be branded so as to make the annual "*rodeo*"—reclamation and separating of herds, so to speak—a peaceful function among the claimants; the taking has to be done all over again each season. This sort of thing leads to trouble; the weak say they are oppressed, the honest claim they are robbed, the first come are first served, in public opinion, regardless of right or justice. There is turmoil. Unsettled conditions prevail. The courts become clogged with disputes which should never have reached them. The "frozen-out" get out and abuse irrigation as an institution. Monopoly, termed "consolidation of interests," ensues. A law and custom which admits of abuse is taken advantage of by dishonest promoters and schemers. Unsound schemes are floated on the market. The country gets a bad name, popularly. "There is no demand for lands." All irrigation enterprise, the good with the bad, is paralyzed.

This sort of thing is preventable. The public, as represented by the states, is the party chiefly at interest. A principal prevention and remedy are to be found in state and governmental administration of streams and diversions, and state promotion of association effort, and state protection of business enterprise in irrigation, under a system that will lead irrigation to develop for the advantage of land owners and irrigators, and the protection of business energy and capital legitimately invested in it; and not merely to be the prey, as a whole, of destroying litigation, ill-advised private promotion, scamp engineering, and dishonest management, operating in many particular cases.

THE LOGIC OF ASSOCIATION.

The logic of association in irrigation may be outlined as follows: Water in due proportion at stated intervals of time is an absolute necessity to the success of each cultivator. By nature water is a thing not permanently divisible, or once-for-all distributable. The water must be acquired in bulk and

subdivided in distribution, and this operation is necessarily continuous throughout each recurring season of utilization. Like the air, that which is not momentarily in use is part of a great undelivered, unapportioned common stock. Some small, *but exceedingly small* part of it, as a whole, may be trapped in a reservoir or herded between the banks of a canal, in process of delivery. But this is only the segregated part of a great common property of all men, in private possession of the reservoir or canal owners. No system of law or custom of country can change its character and function in the economy of nature, as affecting human existence, or alter the disposition of mankind in contemplating its utilizations necessary for that existence.

Of all the uses to which water is put, irrigation is the one in which the interests of individual users are the most interdependent and inseparable. There is a community of interest in every cubic foot that comes into a canal heading and all that escapes at the drainage outlets of the system. The sum of the indirect influences of individual irrigation practice on community welfare, taken with the aggregate of direct effect of each irrigator's practice on the interests of others, is so potent as to make this industry one of the strongest in its tendency towards socialism amongst enlightened and progressive peoples.

There are two broad principles on which irrigation is found to rest in stability and quietude: the one is socialistic; the other, autocratic. Uncontrolled by extraneous power, they are never found associated quiescently in any system of organization The irrigation communities of Spain especially, but those of France also, and in a less degree those of Italy, exemplify the working of one principle. The governmental irrigation establishments of Egypt, Russia and British India present the best examples of the working of the other.

Italian irrigation, as it came a legacy from feudal times, was once most prominently autocratic in its orderings; but, as told in a previous article, modern civilization forced the introduction of community organization in the face of the most powerful adverse influences, even in Italy, to enable the irrigators to deal on a fair plane with the water-right autocrats, and to peacefully manage their own internal community affairs. And this history has been repeated, though with less pronounced examples, in every other irrigation country having an enlightened and progressive agricultural people. It is only with such people as the *fellahs* of Egypt, the *mujiks* of Russia, and the *ryots* of India—the lower classes comprising the irrigators in those countries, for centuries bowed to monarchial rule—that the extreme autocratic principle of irrigation administration can stand. Why? Because progressive human nature will not long endure autocratic rule, no matter how justly exercised, in the distribution of that which is an actual necessity and is at the same time, by an immutable law of nature, already a common property of those being served. The logical outcome must in the end be local communal administration over every irrigation area whose interests distinctly admit of unification.

[TO BE CONTINUED.]

IRRIGATION AND STATE BOUNDARIES.

A PROBLEM OF THE ARID WEST AND ITS SOLUTION.

BY ORREN M. DONALDSON.

OUR Republic is still in its infancy. What we boast to be the foremost civilization of the world is hardly more than the embryo of "ultimate America." The eastern, and older, States, it is true, have attained a certain fixedness of character; but the country as a whole is as yet only in the process of taking form for its mighty destiny. Especially as pertains to the great West, it is not too late to modify and in large degree reshape our National future. Indeed, it is only within recent years that the western half of the United States has been discovered to possess the possibility of any future worthy of consideration. Our fathers thought it a desolate waste, unfit in large extent for human habitation. But under the magic influence of irrigation, this "Great American Desert" promises to become a great American garden, the agricultural rival of the East. Its resources of field, pasture, forest and mine are found to be almost without limit. A few decades hence it will support its full quota of the country's population and contribute its equal share of the nation's wealth.

But the statesmen of a generation ago foresaw for the West only an ignominious future, and were content to shape their legislation accordingly. No further proof is needed of this poverty of their hopes than that found in the unfortunate method, by which, from time to time, they divided this region for the purposes of government. Ignoring natural boundaries and with a total disregard for the many and marked differences of topography and climate, they drew their lines of division almost wholly on parallels of latitude and meridians of longitude, probably as being the easiest and cheapest means of setting the limits to the unimportant Territories and States, which the meager development of the country was expected to call into existence.

Such a method of partition is the worst possible in any region. A State ought to be bound together as a political unit by the greatest community of interest, which is impossible where either a too large area or physical barriers divide its territory into sections likely to be pitted against each other in matters of governmental policy. Such conditions, conducive of political discord, exist in almost every State and Territory of the West. Texas, California and Montana are of so vast dimensions that they must eventually break in pieces of their own weight. Montana, Colorado and Wyoming are each cut in two by the "Great Divide" of the Rocky Mountains. The Cascade range separates Washington and Oregon into unequal portions, unlike in character and climate and with little natural common interest; while the Sierra Nevadas to the south cut off a large slice of Eastern California, which belongs by right of position to the State of Nevada. An imaginary line separates northern Idaho from eastern Washington, to which it is bound by all the ties of a common and rapidly growing civilization; and similar arbitrary bounda-

ries disjoint almost every section that topographical affinity would make one, and parcel it off hither and yon for its political affiliations. In fact, there is hardly a boundary line in all the West, that is not, even when judged by ordinary standards, in some way an outrage on nature and a menace to the best interests of the people.

But it is as a country dependent for its prosperity on irrigation that the West suffers its most serious injury from this unhappy system of division. Here it is not the *land* that forms the basis of the State, but the *water*. And if elsewhere it is desirable that the State be founded on contiguous land areas, in the arid West it is ten-fold more important that the State be based on undivided water systems or drainage basins.

There are many reasons why the entire drainage area of a stream or river system used for irrigation should be under one State authority. The inhabitants of such a territory are of necessity neighbors in greater or less degree, with interests at the same time common and conflicting. The question of water rights is everywhere a delicate one. The present controllable water supply of very few streams is adequate to the land areas available for irrigation, and the farmers along their upper, middle and lower courses are the parties to constant disputes and litigations. The difficulty in the settlement of such cases is vastly aggravated where the course of the stream lies through different political divisions. And there is no river of considerable size in all the irrigation country that does not flow through two or more States or Territories.

POLITICAL UNIFICATION DEMANDED.

But these reasons are insignificant when compared with the great reason for demanding a political unification of each drainage or irrigation district. Under the guidance of wise leadership, the time has now come for a grand onward movement in the irrigation interests of the country. Heretofore, what has been done for the reclamation of the desert has been desultory and without system. Individuals or companies have seized upon portions of streams here and there at hap-hazard, and have used what waters they happened to need, without reference to the greatest utility to be obtained from each river as a whole. In this manner much water is wasted; often the best lands are not cultivated; the catchment areas are given no care and are despoiled of their forests, nature's great conservators of moisture; the vast spring freshets go to utter waste, which, held in reserve, would add immensely to the water supply. But it has been determined that all this shall be changed. Each river basin must be carefully investigated to learn its actual and its possible capacity; the most available lands must be sought out and irrigated at the expense of those of lesser value; the catchment areas must be defined and protected from spoliation; the spring floods and storm waters must be saved to augment the waning currents of mid-summer. For this, great works of engineering are demanded. Big canals must be constructed, scores and even hundreds of miles in length. Immense reservoirs must be built to contain millions of acre-feet of water. In short, each irrigation district must be taken as a unit and developed in its entirety from the first tricklings of its head waters to the last acre of its agriculture. And such a work cannot be accomplished to the best advantage unless the whole system of lands, waters, catchment areas, canals and reservoirs, is under one set of laws and one State authority.

Moreover, such undertakings are too vast for private enterprise; they must be public works. Corporations could doubtless be formed to carry many of them into effect, but the country has already been ably warned against the danger of burdening the prosperity of the great West with the incubus of monopolistic corporations in control of its lands and waters.

The United States Irrigation Survey has given this new movement a good start, but the most that the Federal authority can do is to perform certain preliminary work and point out the way for future achievement. It may be taken as a settled fact that the National government will never undertake the construction of these great irrigation works. They belong by right to the State governments, and were the State boundaries properly drawn, it is probable that no other method would be suggested for their construction than by, or under the direction of, the States in which they are to exist.

CONFLICT OF RIVERS AND BOUNDARIES.

But the States are constituted in the worst possible manner for such works. A little study of the map will show how the water systems of the arid and subhumid regions are crossed and re-crossed by State lines, making systematic irrigation development by the States an impossibility under existing boundaries.

Beginning on the north, we find the Missouri river, for a long distance, free from this difficulty, save that a goodly share of the streams that come to it from the north have their rise across the Canadian border. But the first large branch of the Missouri, the Yellowstone system, is about equally divided between the States of Wyoming and Montana, the waters being caught in large measure in the former State, and flowing northerly and easterly into the latter. The next affluent of the Missouri from this region is the Little Missouri, which rises in Wyoming and flows through corners of Montana and South Dakota into North Dakota. Below the Little Missouri are several minor streams, which lie wholly in North Dakota, and one whose entire course is in South Dakota; but the head waters of the Grand river come from both States, and the north and south forks of the Cheyenne each flow a part of their course in Wyoming and a part in South Dakota, the irrigation on each stream being about equally divided between the two States. The White river rises in Nebraska and flows into South Dakota, while the Niobrara rises in Wyoming and has the rest of its course in Nebraska, with branches coming from South Dakota. The irrigation on the North Platte system lies partly in Colorado, where the river has its origin, partly in Wyoming, through which it flows with circuitous course, and partly in Nebraska; while the South Platte and its tributaries furnish other large irrigation areas likewise divided among these three States. Kansas, Nebraska and Colorado share the waters of the Republican river and its branches.

The irrigation on the Arkansas river is mostly in Colorado, but extends nearly 200 miles across the Kansas border and has already caused much conflict as to the right to the scant water supply, a conflict not likely to be lessened by the construction of the storage reservoirs located by the Irrigation Survey in the Colorado mountain region. The Cimarron river flows back and forth across the border that separates New Mexico from Colorado and Kansas from Oklahoma. The Canadian river's course through the arid district is about half and half in New Mexico and Texas;

and the same is true of the Pecos. The Rio Grande presents a series of conflicting interests from its source in Colorado to its mouth between Texas and the river, and between similar contestants of water rights in New Mexico and Texas along the middle course.



REPARTITIONMENT OF ARID REGION, AS PROPOSED BY ORREN M. DONALDSON.

the Republic of Mexico; the difficulty within the United States being between the rival irrigators in Colorado and New Mexico, along the upper course of

Coming to the Colorado river system, we find the Green river and its tributaries divided among Wyoming, Colorado and Utah, and the Grand river and

its tributaries between Colorado and Utah. The San Juan basin forms parts of Colorado, New Mexico, Arizona and Utah. The Little Colorado and Gila have their head waters in New Mexico and their courses in Arizona. The Kanab is partly in Utah and partly in Arizona and the Rio Virgen belongs to Utah, Arizona and Nevada. The vast areas of irrigable lands along the Colorado, below the Grand canyon, from which, according to Major Powell, there will always flow "an enormous stream of water sufficient to irrigate several million acres," are likewise parts of three political divisions, Arizona, Nevada and California.

The Great Basin presents two very marked instances of conflict between State lines and irrigation interest—the Bear river problem and the Nevada-California problem. The Bear river rises in Utah and flows north into Wyoming, then west into Utah again and again back into Wyoming, pursuing all the while a northerly direction. It then turns to the west into Idaho and after a somewhat extended and sinuous course in that State, comes back to the State of its origin and empties its waters into the Great Salt lake. About midway of its length is Bear lake, a natural storage reservoir for the river's overflow and of much possible value to the irrigation lower down the stream; and this lake lies about half in Utah and half in Idaho, with its outlet in the latter State. The waters for the irrigation of Nevada are furnished largely by the Truckee, Carson and Walker rivers, all of which come into the State from California, where they have their sources in the Sierra Nevada mountains. On the border between the two States is Lake Tahoe, with large storage capacity; but its outlet is in California, as are most of the other reservoir sites of importance—and they are not a few.

The inter-state problems of the Columbia system are found chiefly in the basin of the Shoshone, whose head waters are in Wyoming and which flows a large part of its length in Idaho and then forms a portion of the western boundary of that State. Some of its tributaries from the south rise in Nevada, including the Owyhee, which traverses a corner of Idaho and a part of Oregon before joining the Shoshone. Farther north several other streams flow into Washington from Idaho, including the Pend d'Oreille, which comes down from the mountains of western Montana. The Kootenai, the Okanogan and the Columbia itself, all came from across the Canadian border and, should that region ever become dependent in large degree upon irrigation, would be likely to be the cause of international controversy.

From this cursory review of the situation it can be easily imagined what havoc is likely to result to the agricultural interest of the West from this division of natural irrigation districts by state lines, often cutting off the catchment areas and reservoir sites from the lands to be watered and separating the irrigable tracts of nearly every river basin among different states and territories. I have compiled the following from Major Powell's statements before the Congressional Committee on Irrigation in 1890:

MAJOR POWELL'S TESTIMONY.

"If it had happened that States had been divided by river districts, all these problems could have been solved by the States themselves; but as the facts actually exist, the problems cannot be solved by State governments, and they are of the most serious character and involve interests of enormous magnitude. It is well known to you, gentlemen, how a fishing ground on a little bit of territory between two States comes to be a matter of bitter contest between the states, but what will it be between States when a vast system of agriculture is in controversy between them?

"This is no ideal difficulty. It has arisen between Colorado and Nebraska. Governors have threatened violence, and it has created a great deal of contention. The subject has been introduced into Congress and an investigation ordered. Questions between Colorado and Kansas have in like manner arisen in Congress. Shall the agriculture of Kansas be destroyed in favor of Colorado? or shall the agriculture of Colorado be destroyed in favor of Kansas? are questions already before the Congress of the United States. The same question arises between Texas and New Mexico. Soon it will arise between Colorado and New Mexico. There is a bitter contest at present in the Department of the Interior between Idaho and Utah * * * in reference to a division of the water of Bear river. * * The Governor of Idaho, and the people of Idaho have petitioned the Secretary of the Interior to stop the development of irrigation work by the people of Utah. * * * War would ensue were it an international instead of an inter-state problem. * * * The catchment area is chiefly in Utah, and the irrigation—not the whole of it, but a little of it—is in Idaho, Its reservoirs will be partly in Utah, partly in Idaho and partly in Wyoming. A little agriculture can be practiced * * in Idaho, but the principal part of it commences near the line between Idaho and Utah and extends down the valley to Salt lake. The greater part of the waters are to be utilized there. But in order to utilize these waters fully, somehow or other the right to control the irrigation works in Idaho and Wyoming also must be obtained. * * *

"The Kanab heads in Utah * * * but the irrigable lands lie along the territorial line, a small part being in Utah, the greater part in Arizona. It is thus that the lands that depend upon the same reservoirs and upon the same canals must be divided between the two Territories, The principal farming lands should be in Arizona, the reservoirs must all be in Utah. * * * To the west lie the Rio Virgen and its tributaries. Here is another natural irrigation district; part of its catchment area is in Utah and part in Nevada. The irrigable lands are also partly in Utah and partly in Nevada, and the pasturage lands are in like manner divided. The Rio Virgin is already supplied with several flourishing settlements, but the forests and the grasses are disappearing. It is possible to cut off nearly all the water from Nevada and use it in Utah, and this is being done, and through this agency most of the settlements in Nevada have failed. * * The position of the State line here is peculiarly unfortunate. * * * Here is a large area of Arizona lying on the north side of the Grand canyon, which can be crossed only at one point for 500 miles. This gorge * * is from 2,000 to 6,000 feet in depth. The citizens of Arizona who live on the north side cannot go to their capital or communicate with the people of the other side without going out of the Territory and travelling hundreds of miles. All this district should be attached to Utah.

"Now they are beginning to develop agriculture in the States farther north, and the same question will arise between the Dakotas and Montana, between Montana, Oregon and Washington, between Oregon and Nevada and between California and Nevada. * * Six million acres of land in Idaho will depend wholly upon waters caught in Wyoming. * * * Some means must be provided by which the people of Idaho, who engage in agrculture on these lands can protect their sources of water supply in Wyoming and have control of the irrigation works which they must construct there. * * *

"Three fourths of the agriculture of Nevada depends wholly upon water caught in California * * * The State of Nevada made an appropriation which proposed to give the income derived from the lands which are granted by the United States and some other sources, to the development of irrigation. They passed an appropriation last year, if I remember rightly, of $150,000 to be used in creating storage reservoirs and when we came to examine the condition of affairs, the physical condition, it was found that the work had to be done in California; so it was blocked. The timber above the water sources there must be preserved to protect these water rights. All this great farming district, and it is a rich farming district, requires for its protection authority to manage the forest above the reservoirs. * * These three rivers (Truckee, Carson and Walker) surveys of which have been made can have all their waste waters stored in the state of California and in their own State, but in order to do it there must be some right in the farmers below to control the land above, and when storage basins are thus constructed, there must be established some way in which they can protect them. * * *

"So that the inter-state problems are enormous, so enormous that I almost hesitate to state what I believe to be their magnitude. I think that there is not less than $500,000,000 involved. But one case that I have given you shows that over 5,000,000 acres of land in Idaho depend on waters to be caught and stored in Wyoming. This is simply one illustration; and suppose in that case they are worth only $30 per acre, that means lands to the amount of $150,000,000 just between two States."

A RADICAL REMEDY PROPOSED.

This condition is an evil of great enormity, which demands a remedy immediate and heroic. According to the October number of THE IRRIGATION AGE, the "questions between States are becoming graver and more complicated;" and this difficulty is almost

hopelessly characterized as the "immensely intricate and baffling question of the division of inter-state streams." Major Powell has advocated that the people of each inter-state irrigation district be permitted to set up a government of their own, irrespective and independent of the State governments, for the purpose of making and administering all laws relating to irrigation. This would give to much of the arid region a triple form of government, National, State, and Irrigation District; practically an untried experiment, extraneous, and in some degree inimical, to the great constitutional system upon which the American Republic is founded.

I make bold to propose what seems a better plan, very radical it is true, and yet sufficiently in harmony with precedent and in perfect accord with the principles of our government:

Let there be a repartition of the arid and subhumid West, wiping out such of the present State and Territorial lines as are at variance with the irrigation interests, and establishing new boundaries in accordance with the natural contour of the country, and with special deference to the requirements of irrigation.

The States thus constituted could be given the possession of the irrigable lands, or not. They could issue bonds and go into the construction of vast irrigation works, or not. Whatever policy or policies should be decided upon further, the States would be wholly free for their pursuit, untrammeled by any perplexing inter-state entanglements.

THE NEW PARTITION.

The accompanying map shows how this plan can be accomplished to what seems to me the best advantage. Of course it is impossible to include the largest rivers each in one irrigation district or in one State; but with the exception of the Missouri, Rio Grande, Colorado, Columbia and Shoshone, and of the smaller rivers, Pit and Klamath, no stream in all the irrigation country, under this partitionment, flows from one political division into another, each having its entire course through the arid region of the United States, confined within the limits of one State or Territory. The inter-state division of these five big rivers would be easily accomplished, if each State would simply conserve all it could, and use all it could, of the waters caught within its limits, leaving the surplus, if any, to the next State down the river. Careful investigation would determine in each case what this surplus would be.

This partitionment would give twenty-six States and Territories instead of the eighteen that now constitute the western half of the United States, thus securing to the West its equal influence with the East in National affairs, to which its equal population will give it full title in the not distant future. Fifty-seven would then be the number of States and Territories in the Union.

The average population of these western political divisions would be about 380,000 inhabitants, and their average size about 73,500 square miles, the areas being for the most part remarkably uniform, but increasing in the more barren regions and decreasing where the water supply, either from stream or rainfall, is plentiful. The boundaries are drawn almost wholly upon natural lines, the Rocky mountains, the Sierra Nevadas and the Cascades, each being used for nearly their entire length; and the Missouri, Colorado, Columbia and Shoshone rivers coming into similar service where, because of their unavailibility, their navigability or their abundance of water, the demands of irrigation seem not to forbid. The railway development of the West gives to each of these divisions good and growing transportation facilities, and accords with the new partitionment very noticeably. The proposed divisions would nearly all be entitled to statehood. They are as follows, names being assigned to the new divisions merely as a matter of convenience.

NEW BOUNDARIES DESCRIBED.

DAKOTA.—Area, 72,500 square miles; population in 1890, 463,000; estimated population in 1894, 700,000; comprising those parts of North and South Dakota east of the Missouri river and of the Mouse River valley, including the James river valley and the western half of the valley of the Red river of the north; a district that ought never to have been divided, the Missouri river being nature's line upon which the old Dakota Territory should have been cut in two.

WEST DAKOTA.—Area, 78,500 square miles; population in 1890, 53,000; estimated population in 1894, 75,000; comprising most of the western and arid part of North and South Dakota, the northeastern part of Wyoming, and small sections of Montana; being all the region watered by Big Muddy creek and the Little Missouri, Knife, Heart, Cannon Ball, Grand, Moreau, Cheyenne and Bad rivers and other affluents of the Missouri, which flows across the State and along its eastern boundary.

NEBRASKA—Area, 70,000 square miles; population in 1890, 948,000; estimated population in 1894, 1,300,000; comprising the present Nebraska plus those portions of the White and Niobrara river basins now in the States of South Dakota and Wyoming, and minus that section of its territory drained by the Republican river and by the Platte river system in the arid country.

KANSAS—Area, 80,000 square miles; population in 1890, 1,370,000; estimated population in 1894, 1,650,000; comprising the present Kansas plus the head water region of the Republican and Smoky rivers now in Colorado, and the middle course of the Republican river now in Nebraska, and minus so much of the Arkansas river valley as lies in the arid region joining Colorado, and that southern portion of its territory drained by certain streams that rise in Kansas and flow southward across the present State line.

OKLAHOMA—Area, 64,000 square miles; estimated population (including Indians) in 1890, 350,000; estimated population in 1894, 500,000; comprising Oklahoma east of the 99th meridian, all of Indian Territory and that southern part of the present Kansas already described as drained by waters flowing into Oklahoma.

MONTANA—Area, 79,000 square miles; population in 1890, 74,000; estimated population in 1894, 100,000; comprising, with the exception of the sources of several streams that rise in Canada, all the Missouri river basin from its headwaters to about the 105th meridian; including all the present Montana, excepting that portion lying west of the Continental Divide tributary to the Columbia river system, that part drained by the Yellowstone river and its branches and those parts in the extreme east already allotted to West Dakota.

YELLOWSTONE.—Area, 72,000 square miles; population in 1890, 19,000; estimated population in 1894, 30,000; comprising all the region drained by the Yellowstone river and its tributaries, the Big Horn,

Tongue and Powder rivers and numerous lesser streams; the territory being included at present about half in Wyoming and half in Montana.

COLORADO.—Area, 60,000 square miles; population in 1890, 259,000; estimated population in 1894, 350,000; comprising what is now northeastern Colorado including Denver, southeastern Wyoming and a part of western Nebraska; being that portion of these three States drained by the north and south branches of the Platte river system, which unite a little west of the eastern boundary at the edge of the arid region.

SOUTH COLORADO—Area, 74,000 square miles; population in 1890, 175,000; estimated population in 1894, 250,000; comprising the southeastern quarter of the present Colorado, the southwestern corner of the present Kansas, the northwestern corner of the present Oklahoma—including the "Panhandle," a strip of northern Texas, and a liberal section from New Mexico; being the territory drained by that part of the Arkansas river system in the arid region, including, besides the main stream of the Arkansas, its tributaries, the Cimarron and the north and south forks of the Canadian, all of which cross the eastern boundary into humid Oklahoma before flowing together.

WYOMING—Area, 67,500 square miles; population in 1890, 73,000; estimated population in 1894, 100,000; comprising nearly the whole of the southwestern quarter of the present Wyoming and large portions of western Colorado and eastern Utah; including all of the Colorado river system to a point a little below the junction of the Green and Grand, the territory being watered by these rivers, and their tributaries, the San Rafael, Price, DuChesne, Yampa, White, Gunnison, Dolores and other streams.

NEW MEXICO—Area, 86,500 square miles; population in 1890, 110,000; estimated population in 1894, 125,000; comprising the northwestern third of the present New Mexico, the southwestern corner of Colorado, the southeastern corner of Utah, and northeastern Arizona; embracing the Rio Grande valley, from the sources of the river south to the 34th parallel of north latitude (at about which point begins the catchment area for another natural irrigation district farther down the stream), the valleys of the San Juan river and its tributaries, and the basin of the Little Colorado.

RIO GRANDE—Area, 102,000 square miles; population in 1890, 73,000; estimated population in 1894, 90,000; comprising the southeastern half of the present New Mexico and the western end of Texas; being all the territory in the United States tributary to the Rio Grande river between the 34th parallel of north latitude and the mouth of the Pecos, including all the country drained by the latter.

TEXAS—Area, 70,000 square miles; population 1890, 1,335,000; estimated population 1894, 1,600,000; comprising that humid portion of the present Texas east of the western line of Dallas county projected due north to the Red river, and extended on the south so as to include Ellis, Hill, Bosque, Hamilton, Coryell, Bell, Milam, half of Lee, Washington, Austin, Fort Bend and Brazoria counties; including the cities of Galveston and Dallas.

SOUTH TEXAS.—Area, 70,000 square miles; population in 1890, 500,000; estimated population in 1894, 600,000; comprising all the southern end of the present Texas, including the city of Austin, and extending on the northwest as far as the 31st parallel of north latitude, the northern boundary being slightly modified to suit the drainage; about half of the State being in the arid region and partially tributary to the Rio Grande.

WEST TEXAS.—Area, 71,500 square miles; population in 1890, 375,000; estimated population in 1894, 450,000; comprising a small corner of the present Oklahoma and all that part of the present Texas not already otherwise appropriated, including Fort Worth; mostly an arid country drained by streams flowing east from the edge of the "Llano Estacado."

ARIZONA.—Area, 91,500 square miles; population in 1890, 58,000; estimated population in 1894, 75,000; comprising the present Arizona, minus the parts north of the Grand canyon and of the watershed south of the Little Colorado, and plus a corner of the present New Mexico and a strip from Nevada and California; being all of the Colorado river system south of the Grand canyon, including the Gila and its branches.

UTAH.—Area, 83,000 square miles; population in 1890, 214,000; estimated population in 1894, 250,000; embracing all the region tributary to the Great Salt lake, including Utah lake, the Jordan and Weber rivers and the entire Bear river system, the country along the Sevier river and its tributaries, and the lands along the streams that flow from the west and the north into the Colorado river between the new Wyoming boundary and the mouth of the Grand Canyon; thus comprising all of the present Utah minus a narrow strip on the northwest and about a quarter of its area on the east, and plus small parts of the present Idaho and Wyoming and large sections from the present Nevada and Arizona.

NEVADA.—Area, 118,000 square miles; population in 1890, 73,000; estimated population in 1894, 75,000; comprising the present State, minus its southeastern and northeastern corners, extended on the west to the mountains to include the headwaters of the Truckee, Carson and Walker rivers, and on the north to include the desert lake region of Oregon and the headwater district of the Pit and Klamath rivers, which flow through the mountains to the more humid regions on the west; also embracing Owens river and lake on the south, and all of the Humboldt river basin in the central part.

IDAHO.—Area, 70,000 square miles; population in 1890, 42,000; estimated population in 1894, 75,000; comprising all the Shoshone valley, from the river's source in the Rocky mountains to a point a little below the mouth of the Malheur, including the Owyhee and Malheur valleys, together with the country around Lakes Malheur and Harney; thus embracing the southern half of the present Idaho, and sections from the present Wyoming, Utah, Nevada and Oregon, the northern boundary being brought to the river from the east along the watershed between the Boisé and Payette rivers, and from the west along the height of land north of the Malheur.

WALLOWA.—Area, 69,000 square miles; population in 1890, 112,000; estimated population in 1894, 135,000; comprising that part of the present Idaho drained by the Payette, Weiser, Salmon and Clearwater rivers, that part of Washington south of the Shoshone, and that part of Oregon east of the Cascade mountains, drained by the Burnt, Powder, Grande Ronde, Walla Walla, Umatilla, Willow, John Day and Deschutes rivers.

MISSOULA.—Area, 66,000 square miles; population in 1890, 144,000; estimated population in 1894, 225,-

000; comprising that part of Washington east of the mountains, the northern part of the present Idaho, and all of the present Montana west of the Great Divide of the Rockies; being all of the Columbia river basin south of the Canadian boundary, east of the Cascade mountains and not already assigned to the new States of Idaho and Wallowa, including the Pend d'Oreille, Spokane, Okinakane, Wenatchee and Yakima rivers and many other waters.

SOUTH CALIFORNIA.—Area, 55,000 square miles; population in 1890, 207,000; estimated population in 1894, 275,000; comprising with the exception of the strip along the Colorado river, all of the present State of California lying south and east of the headwater region of the San Joaquin river, and extending along the coast on the northwest as far as San Luis bay and into the interior on the north as far as the 37th parallel of north latitude, including a little section of the present State of Nevada.

CALIFORNIA.—Area, 41,500 square miles—about the size of Ohio; population in 1890, 668,000; estimated population in 1894, 765,000; comprising all of the San Joaquin river basin together with the coast region directly to the west, including the city of San Francisco.

NORTH CALIFORNIA—Area, 42,000 square miles—nearly as large as Pennsylvania; population in 1890, 308,000; estimated population in 1894, 350,000; comprising practically the whole of the Sacramento river basin west of the Sierra Nevada mountains—including the city of Sacramento, also the coast region directly to the west, and the Klamath valley on the north, the height of land beyond the Klamath forming the northern boundary; being largely outside of the arid region and separated on the south from the arid new California by the Bay of San Francisco, the Sacramento river and the water-shed which extends from the Sacramento river east into the mountains near the southern edge of Eldorado county.

OREGON—Area, 30,000 square miles—nearly the size of Indiana; population in 1890, 243 000; estimated population in 1894, 325,000; comprising that portion of the present Oregon lying west of the Cascade mountains, with the southern boundary slightly modified to suit the local drainage; including the Willamette valley, and having an ample rainfall, which alone is sufficient reason for separating it from the arid region east of the mountains.

WASHINGTON—Area 29,000 square miles—about the size of South Carolina; population in 1890, 232,000; estimated population in 1894, 325,000; comprising that part of the present Washington west of the Cascades, having good rainfall and destined to contain the greatest commercial center west of the Mississippi.

[TO BE CONTINUED.]



WEST VIEW OF THE SWINDEN PECAN FARM IN TEXAS.

PECAN FARMING.

A PROFITABLE INDUSTRY FOR THE ARID REGION.

BY F. A. SWINDEN.

AFTER careful investigation in 1886 I bought land for pecan culture on Pecan Bayou in Texas where I found the tree growing in its native state. I have now an orchard of 11,000 trees on my 400 acres that are one to six years old. As nut culture is attracting attention in the arid region, and the pecan should thrive wherever the English walnut does, my experience may be of interest.

The pecan tree is valuable for its timber as well as for its nuts. Axe and hoe handles, gun stocks, furniture and various other useful articles are made from the wood. The nut, besides being used as a dessert, is made into cakes and candies, and its oil brings the highest price in the market from clockmakers, gunsmiths, etc. The tree is of slow growth and long-lived; the cut shows one on my place over one hundred years old in its wild state. The tree grows to the height of eighty or more feet, and its home is in the rich alluvial valleys, and will not succeed where the soil is not rich and deep.

There are two distinct varieties, known as the soft and hard shell. The best among the soft shell varieties are known as the Swinden and Stuart. The wild varieties are generally hard shelled.



PECAN TREE OVER 100 YEARS OLD, ON PECAN BAYOU.

I have nearly 11,000 trees on my 400 acres, planted forty feet apart each way. As there is no enterprise but has its drawbacks, I must say I had them to begin with—the first thing being the wood louse or ant, which attacked the yellow pine stake place by every nut. They then went from the stake to the tree, and thus killed the young stem; but this was obviated by cypress boxes, eighteen inches high, tarred at the bottom, which also served the purpose of protecting the young tree from the depredations of the rabbits and other rodents which did me considerable damage. Squirrels will unearth the nuts when planted, and rabbits will gnaw the bark and cut off the tender sprouts.



Fig. 1. Swinden,



Fig. 2. Stuart,



Fig. 3. Van Deman.



Fig. 4, Common Wild Pecan.

DIFFERENT VARIETIES OF PECANS.

The tree will come into bearing in eight to ten years. A tree at that age will produce one bushel or 42 lbs., and sell readily at $5. At fifteen to twenty years the yield will be ten bushels or more to the tree. I have seen trees produce as high as forty bushels, and I have paid $150 for the product of one tree. Thus we can readily draw the conclusion that the profits of the pecan will soon rival that of the famous Florida and California orange groves. The price of pecans varies with quality and size. The small wild

ones are sometimes less than $2, while the extra large ones are in demand at as high as $8. There is no fear of glutting the market with these extra sizes as few are willing to wait till they come into bearing. There is no safer life insurance than a well established pecan orchard. There are men to-day deriving a good living from few trees planted by them, and others I know of who are getting from $3,000 to $5,000 per year from trees planted by their fathers. The land between the trees need not lie idle while the trees are coming into bearing, but can be planted to hoed crops and made to pay. I have netted on an average over $1,500 per year for the past six years from my land. I advise no one to plant in localities where there is too much rain, as the pollen is liable to be washed away, and thus keep the tree from fructifying and making fruit.



ONE METHOD OF MEASURING WATER.

MEASUREMENT OF WATER IN STREAMS.

IN TAKING out water from a small stream for irrigation or power purposes it is usually important to measure the amount of water that may be secured from that source. James Leffel of Ohio contributes the following from his pamphlet on water power and its utilization. The method of operation is plainly indicated in the illustration. Fasten a stout board across the stream with each end set in the bank. Cut a notch in the board, deep enough to pass all the water, and long enough to reach about two-thirds across the stream. The bottom and ends of the notch B in the board should be beveled on the down stream side, leaving the upper edge almost sharp. The stake E should be driven in the bottom of the stream several feet above the board, on a level with notch B; this level being easily found, when the water is beginning to spill over the board.

After the water has come to a stand, and reached its greatest depth, a careful measurement can be made of the depth of water over the top of stake E. Such measurement gives the true depth of water passing over the notch, because if measured directly on the notch, the curvature of water would reduce the depth. The line D is a level from the bottom of notch B, to

the top of stake E; while the dotted line C represents the top of the water, and the distance between the lines gives the true depth or spill over the weir board. The line D has the appearance of running over the top of the board; when in fact it passes behind it—the reader is supposed to look through the board and the post. The surface of water after passing below the board, should not be nearer the notch B than ten inches. Neither should the nature of the channel above the board, be such as to force or hurry the water to the board; but should be amply wide and deep, to allow the water to approach the notch quietly. If it passes the channel rapidly, it will be forced over the notch and a larger quantity will pass, than the table indicates.

The weir table herewith gives the number of cubic feet of water passing per minute, over the notch for each inch in breadth. The figures 1, 2, 3, etc., in the first vertical column, are the inches depth of water over the weir; the first or top horizontal line is fractional parts of an inch. The body of the table shows the cubic feet, that will pass each minute, for each inch depth of weir, from 1 to 25 inches. Each of these results is for one inch in width; for any particular number of inches width of weir, the result obtained in table, must be multiplied by the number of inches of breadth the weir may be. Suppose the notch in the board is twenty inches wide; and the water at the stake E, 5⅛ inches deep; in the first column find the figure 5. Follow the horizontal line of figures until a vertical column is reached containing ⅛ fraction at the top. The square where these two columns meet will contain 5.18 (five and eighteen-hundredths) cubic feet. This is the quantity of water passing for each inch in width; since the supposed weir is twenty inches, this result must be multiplied by 20, which gives 103.6 (one hundred and three and six-tenths) cubic feet per minute. In this manner the water passing any width of weir, of any depth from 1 to 25 inches, can be easily calculated.

WEIR TABLE 1 TO 25 INCHES.

Inch.		⅛	¼	⅜	½	⅝	¾	⅞
1	.40	.47	.55	.65	.74	.83	.93	1.03
2	1.14	1.24	1.36	1.47	1.59	1.71	1.83	1 96
3	2 09	2.23	2.36	2.50	2 63	2.78	2.92	3.07
4	3.22	3.37	3.52	3.68	3.83	3.99	4.16	4.32
5	4.50	4.67	4.84	5 01	5.18	5.36	5.54	5.72
6	5.90	6.09	6.28	6.47	6.65	6.85	7.05	7.25
7	7.44	7.64	7.84	8.05	8.25	8.45	8.66	8.86
8	9.10	9.31	9.52	9.74	9.96	10.18	10.40	10.62
9	10.85	11.08	11.31	11.54	11.77	12.00	12.23	12.47
10	12.71	13 95	13 19	13.43	13.69	13.93	14.14	14.42
11	14.67	14.92	15.18	15.43	15.67	15.96	16.20	16.46
12	16.73	16.99	17 26	17.52	17.78	18.05	18.32	18.58
13	18.87	19 14	19.42	19.69	19.97	20.24	20.52	20.80
14	21.09	21 27	21 65	21.94	22.22	22.51	22.79	23.08
15	23.38	23.67	23.97	24.26	24.56	24.86	25.16	25.46
16	25 76	26.06	26.36	26.66	26.97	27.27	27.58	27.89
17	28.20	28.51	28.82	26.10	29 45	29.76	30.08	30.39
18	30.70	31.02	31.34	31.66	31.98	32.31	32 63	32.96
19	33.29	33.61	33.94	34 27	34.60	34.94	35.27	35.60
20	35 94	36.27	36 60	36.94	37.28	37 62	37.96	38.31
21	38.65	39 00	39.34	39.69	40.04	40.39	40.73	41.09
22	41.43	41.78	42.13	42.49	42.84	43 20	43.56	43.92
23	44.28	44.64	45.00	45.38	45.71	46.08	46.43	46.81
24	47.19	47.55	47.91	48.28	48 65	49 02	49.39	49.76

WINTER IRRIGATION OF ORCHARDS.

BY F. C. BARKER, OF LAS CRUSES, NEW MEXICO.

AT the request of the editors I will briefly submit the results of my observations on the question of the winter irrigation of orchards in this part of the country, and the conclusions which, it appears to me, we may draw both from practical experience and scientific knowledge, for the consideration of readers of THE IRRIGATION AGE.

When, some four years ago, I came out to New Mexico, I found that the prevailing practice with orchardists was to withhold water from the trees during September and October, in order to let the young wood ripen; then give one irrigation in November and not apply water again until the peach buds had come into blossom. The reasons alleged for this method of treatment were, that the trees did not need water during the winter months, when they were dormant, and that by keeping off the water the fruit buds were retarded. It is needless to say that no objection can be raised against withholding the water while the young wood is ripening: but that by keeping the water from the trees in the spring the blossoms are thereby held back has been shown to be a fallacious idea. The fact is that the bursting of the bud is entirely dependent upon the state of the outside and surrounding atmosphere, and if the application of water to the roots has any effect whatever upon the buds, the evidence is in favor of the retarding rather than of hastening the blossoming period. It would appear that the mistaken notion about trees needing no artificial irrigation during winter has arisen from two sources. Firstly, there is a popular delusion that the tree is dormant during winter. Anyone, however, who has heeled in young trees in the fall and lifted them again in the spring, cannot have failed to notice that the roots have made growth during the interval, and, by careful measurements made at the Experiment Station here, it has

been proven that even the trunks of the trees, and probably the branches, actually increase in girth during the winter months. It is therefore clear that the tree is in active growth during a great part of the winter and is laying up a store of vitality for the coming summer. If the tree during that period suffers from drouth its vital energy is weakened.

Secondly, the people here have been told that it is not customary to irrigate orchards in California during the winter. They, however, have not taken into account that heavy rains fall in winter over the greater part of the Pacific coast, whereas in the region of the Rocky Mountains the winter months are our dry season. Moreover, if we look at those countries where fruit grows to the greatest perfection without irrigation, we shall see that they have the principal rainfall during the winter months. I need only point to the Santa Clara Valley in California and the south of France in Europe, where nature gives us a valuable lesson in the application of water to fruit trees.

In the Nesika Valley where I reside, I know of two large peach orchards, both on similar land and within a quarter of a mile of one another. One was not irrigated during the winter, while the other received three or four copious irrigations. The peach blossoms opened a few days later on the irrigated orchard, while the fruit ripened at least a week ahead of the other. I am inclined to think that the moisture of the soil tended to keep the air around the trees cool, and so retarded the blossoms, but when the fruit on the irrigated trees once started, it rapidly overtook that on the others, which, owing to lack of moisture during the winter, were deficient in vitality, whereas the irrigated trees were in a condition to devote all their energy to the development of the fruit.

The experiment has also been made here of irrigating peach trees only twice a year, viz., once in November and again in March. They however failed to produce a single basket of first-class marketable fruit; all were small and stunted, and by July the trees began to shed their leaves and showed unmistakeable signs of giving up the ghost. Nevertheless, these trees received constant cultivation and every care so far as pruning and the thinning of the fruit were concerned. On the other hand, the finest and earliest peaches were raised on those orchards which received winter irrigation and a copious supply of water every eight or ten days from the time the fruit set until it was gathered.

In these parts it has also been customary to hill up the vines in November and to apply no water during the winter. It is not the cold which is feared, so much as the dry winds in the early months of the year, and if the trunk of the vine be not protected, it is apt to crack and the buds to winter-kill. A gentleman in the valley, who has made the experiment for two years, assures me that if the vines are irrigated during the winter, they go through with perfect safety and without the necessity of any hilling up. It would certainly seem that there is as good reason for irrigating vines in winter as there is for irrigating fruit trees.

Finally, there is another good reason why orchards and vineyards should be irrigated in winter. The work can be done when the farmer is not otherwise busy and when the water is invariably plentiful. Water, which would otherwise be wasted, is saved by thoroughly working the ground down to a good depth, and, should there be a short supply of water during the summer, the trees are able, by means of capillary attraction, to draw upon this reserve of water which was stored up during the winter.

TWO COLORADO ARGUMENTS.

Five years' observation and experience in California, where irrigation is reduced to a science, has revealed facts that would add great value to the system practiced on the great plains east of the mountains and which will reduce the cost of reservoirs probably one-half and add much to their safety. Thus argues W. Hildreth in *Field and Farm*. For the last ten years winter irrigation has been gaining favor for the following reasons: First, water that would run to waste in winter is saved by thoroughly soaking the ground down deep. Secondly, there is more time to devote to it in winter. In this Colorado has the advantage of the Californians, as our subsoil will hold the water better, where it would be used in the spring by capillary attraction as needed.

Nearly the whole winter could be utilized in getting water into deep furrows on plowed land and into pools made about fruit trees in the fall before freezing. If the water froze in the furrow so much the better, as it would thaw and seep into the ground in the spring. The main cause of damage by drouth in this country is that we get little or no snow or rain in the winter, and what little rain comes in the spring only wets the surface a few inches down, then when the warm drying winds come it soon evaporates and crops are stunted or ruined entirely. If a system of resorvoirs were established the farmers in a few years would see the utility of winter irrigation and there would be a pressing demand for all of the water as fast as it came from the mountains, so that much smaller reservoirs would do, saving first expense of building, cover less ground and add much to their safety.

The safety of all artificial water storage depends mostly on the plan of getting rid of the waste water. The dams and waste weirs should be planned by experienced engineers and not by inexperienced favorites, and the construction should be under the supervision of thorough men. Surface irrigation in hot drying weather is soon lost by evaporation, to say nothing of the baking or inconvenience of wetting growing crops. Wet the ground in winter when there is nothing in the way and time and water are plenty and evaporation less. That would get a great deal of water into the ground where it would do good, that would otherwise evaporate from the surface of large reservoirs if held until needed for growing crops in summer.

There is no loafing or shirking about a tree, says a writer in the Denver *Times*. It simply does its best, and while this process is being energetically proceeded with it is making wood growth preparatory for the crop another year. When the crop is gathered the very process is a weakening one to the trees, and in order to overcome this weakening process then is the time to use a stimulant. By irrigation and cultivation—and the first is nearly useless without the last—the fruit buds are developed, made strong, and if a little cold or frost comes next spring out of season they possess the vigor to resist it, and thus the orchardist will derive all the benefit of irrigation. We have noticed that dry orchards of Colorado are less certain to bear fruit year by year just because there is no way to apply moisture at the very time the buds are forming, which is the most important time of all. If an orchard fails to bear, the cause may usually be traced to this lack of moisture and irrigation.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

Short, practical articles, notes of experience and observation, are invited from the readers of THE IRRIGATION AGE who are interested in the promotion of the idea of the small diversified farm providing to the fullest economical extent all of the various articles of food, clothing, etc., required by the family.

THE ORCHARD FOR THE SMALL FARM.

P. J. SPRENG, before the Shawnee County, Kansas, Horticultural Society.

SUCH an orchard should be of such size and composition as may, under stress of unfavorable conditions, yet reasonably be expected to afford its owner, as near as may be, a continuous supply of good fruit from the earliest ripe to the latest keeper, embracing a period of at least ten or more months of the year; and that, when the season shall have been propitious and the yield abundant, the surplus shall find a ready market by reason of adaptability and merit.

To such ends I would plant approximately 200 apple trees, about as follows: For early—Benoni, 5; Early Harvest, 5; Cooper's Early White, 5; Maiden's Blush, 5; Sweet Talman or Bailey, 5.

Fall—Fameuse, 5; Jonathan, 10; Grimes' Golden, 10; Smith's Cider, 40.

Winter—Ben Davis, 40; Winesap, 20; Missouri Pippin, 20; York Imperial, 20; Rawle's Genet, 10 Total, 200.

In pears I would confine myself to the Seckel and Kieffer; in plums to to the Wild Goose and Leka, which ripens in October; of cherries I prefer the Early and Late Richmond, the common and English Morello; of quinces the Orange; currants, Red Dutch; grapes, Moore's Early, Dracut Amber, Worden, Concord, Elvira, Pocklington, Niagara and Goethe.

These I would plant where it would most nearly conform to the convenience of the family and the general arrangement of the premises, regardless of the generally expressed preference for a north slope (or any other slope, for that matter). I much prefer a site approximating the level, with a fertile surface and porous subsoil.

The apple trees should be set 30x30 feet. The trees in the rows north and south may be alternated with peaches at small expense to the owner and little inconvenience to the cultivator, and they will probably have outlived their usefulness by the time the apple trees have attained their growth, and may be removed without loss. I would plant in the spring, two-year-old trees that were not taken up (or disturbed) in the fall, and set them about two inches deeper than they stood in the nursery row, on such soil as above indicated. On a non-porous subsoil the tree should not be set so deep as to promote the accumulation of water about the roots. Plant popcorn, sweet corn, potatoes or cabbages in the plat, and cultivate thoroughly for from three to five years, then sow to red clover, mow twice a year and keep all stock out. Keeping the trees well pruned, shaped and balanced from the start, will not be regretted later on. Wash the trunks with a solution of lye at least twice a year—April and last of June, and sprinkle flour of sulphur on the ground about the trunk, covering it (the sulphur) with sufficient earth to keep it moist, and few, if any, borers will work under that surface. Protect from rabbits. A good way to do this is to kill one, and cut in pieces and rub the trunk of tree with it. The pears may be set twelve feet apart in row, the cherries twenty feet, the grapes eight feet in row, and rows twelve feet apart. The currants should have very rich soil, and be planted five feet apart in row, and protected from the sun by planting on the north side of a board fence or row of trees. Quinces and gooseberries will do well anywhere in good soil. These suggestions are in line with my personal experience. Whether or not they merit the consideration of others in any degree, may be determined by investigation or personal experience, keeping in mind that loss and disappointment is the price of ignorance, negligence and sloth. This always has been, is now, and always will be, susceptible of verification at short range.

Pork and Dairying Together.—A writer in the *American Cultivator* criticises the common practice of throwing whey, milk and buttermilk into the swill-barrel and leaving them there until sour. He says that if pig-raisers would only appreciate the fact that the best part of the swill is lost to the animals when allowed to sour and ferment, there would be less of this old-fashioned slops fed. Pigs want sweet food, and the sugar contained in sweet milk does them as much good as any of the other constituents.

Dairymen may learn a lesson in feeding their pigs with the buttermilk, whey and washings. There was some justification in their action of throwing everything into the swill for somebody else's pigs, but when they have their own pigs to look after, it is a poor cutthroat policy. Save the buttermilk and whey by all means for the animals, but give to them while sweet. This can be done by carefully washing and scalding all of the utensils each time before the swill is put into them, and then by feeding the swill fresh each day. Just enough pigs should be kept to use up this waste and no more. Sour bread and slops from the house should not be thrown in the barrel. They should be given to the swine separately. If mixed with the buttermilk and whey they soon sour the whole mass, and make the barrel filthy.

Sweet, fresh whey has great feeding value, although some have claimed that it has killed their pigs. This has been found only in cases where the animals were made to depend upon this alone for food, while all other solids are denied them. An exclusive diet of any food is bad for all animals. Several of the experiment stations have tested the value of whey, and the results show that, fed alone, whey was not a good food for the swine, but when fed with grain, cornmeal or shorts, almost a perfect food was formed. The whey does not make muscles at all, and hence the need of grain and solid foods. It makes fat rapidly, and when grain is mixed with it the flesh is firm and solid, making the best kind of pork imaginable.

Good Management.—A Massachusetts man, driving through New Hampshire, pulled up his horse to chat with a farmer about his crops. Some of the old man's remarks were spiced with humor and some of them, the tourist declares, were almost as good as a sermon.

"My corn's done fust-rate," the farmer said, cheerfully. "An' I ain't a-goin' to take no credit for supplyin' the preacher's folks with it, nuther. Some say I'm too freehanded but I tell 'em it ain't gen'rosity, it's jest common sense an' forehandedness. I tell 'em my preacher's patch is wuth more to me'n 'tis to the preacher himself. Why, I cal'late it's havin' of that patch that's keep' my whole field a-goin' fer the last five years."

"Where is your preacher's patch situated?" inquired the stranger, with pardonable curiosity.

"Right slap in the middle o' the field," was the reply.

"Any special reason for having it just in the middle?" asked the stranger.

"Well, yes," said the farmer, with a twinkle in his eye. "Ye see, that's where my long-headedness comes in, stranger. It stands to reason the Lord ain't a goin' to let the preacher suffer—an' I never see folks that set so by corn as his do—an' so I reckoned that when He was a-pervidin' rain an' sunshine oer the preacher's patch by havin' of it right slap in the middle o' the field there'd most likely be enough o' both them desirable ingrejients to keep the rest o' the field a-goin' an no harm done!"

And with no sign of amusement except what appeared in his bright old eyes the farmer turned the conversation to the state of politics in New Hampshire.—*Youth's Companion.*

Do Not Sacrifice the Sheep.—The recent tariff law placing wool upon the free list has greatly discouraged flock masters in all parts of the country. In the Western States and Territories tens of thousands of sheep have been sold at merely nominal figures or slaughtered merely for their pelts. While it may be true that our farmers will be unable to maintain a successful competition against the woolgrowers of Australia and other cheapland countries as to certain grades of wool, it is manifestly unwise to enter upon a wholesale sacrifice of flocks. It is by no means impossible that with proper attention the market for mutton can be very greatly extended throughout the United States. Unlike the English we are scarcely to be described as a mutton eating people, and yet the consumption of fresh mutton is said to be largely on the increase. The sheep is so valuable an animal on the average farm that its abolishment from the land would entail an immense loss. No more efficient agent for consuming weeds, briars, etc., and converting into cash what would otherwise be a great curse, is known to American agriculture than the sheep. The wools so largely imported hitherto have been mostly of the coarser types, and it will be those large herds of common sheep feeding upon the public domain or other cheap land among the mountains or in the far western prairie states, which will suffer most from the new tariff. Those farmers who handle a comparatively small number of sheep and take proper care of them need not despair of continuing to reap a profit from their flocks. The true course should be to take more pains to have the best breeds, then give the animals extra care and attention with a view to making a lesser number even more profitable than the previous herds. Friends of the new tariff measure never weary of asserting that the cheapened price of wool will so stimulate the demand that practically as good results will be maintained for that staple as heretofore. Practical experience alone can determine the ultimate value of the argument. At all events, farmers generally, may safely consume more fresh mutton and thus doubtless reap some benefits not hitherto enjoyed, while caring better for their flocks with the almost certain advantage of increased value at the butcher's, if not at the shearing shed.

Necessity of Co-operation.—No single individual or weak organization can possibly stand up before the combinations of capital, energy, greed and business cunning which confront growers in every market. The great problem before producers of perishable fruits is not that of growing fruits, but of marketing them, of putting the products of the orchard and vineyard upon the tables of consumers at prices which they can pay, and which will also leave a reasonable margin in the hands of the producer. A careful study of the markets shows that, while the producer often receives but scant returns for his labor, the consumer of the fruit paid a good price for it. These conditions necessarily result from defective methods of distribution. To begin with, all consignments of fruit in a promiscuous way to commission agencies in distant markets must be discontinued. And there is no way to regulate shipments so as to avoid gluts in the various markets,and require honest and early returns, except through co-operation. If their own experience does not fully convince fruit growers of the supreme folly of attempting to "go it alone" in their business, the example of men in other lines all about them should certainly afford convincing object lessons. Did any one ever hear of the manufacturer sending a carload of his product to the "storekeeper" at Smithville or Milpitas with the request that he sell it out with the best advantage he could and remit the proceeds? Of course not. Such a proceeding on the part of a cotton manufacturer would at once stamp him as a lunatic whose friends would feel in duty bound to take care of. But this is done every day in the year by fruit growers and farmers generally. But, it may be asked, is there a remedy? There certainly is; but it does not lie in the continuance of the single-handed struggle which the farmer has so long and so unsuccessfully waged. What would the armies of Napoleon or Grant have accomplished as a struggling aggregation of unorganized and undisciplined men? Nothing, of course. Everywhere and always a platoon of trained veterans under competent leadership is more than a match for an unorganized mob of ten times the number. This is true in war, true in diplomacy, true in business. The first great lesson then for farmers, and especially for fruit growers, to learn is that their interests are common, and that their safety and welfare lie only in the direction of association and harmony in the transaction of their business.

Co-operative Poultry and Dairy Farming.—Diversified farming on small irrigated farms lends itself peculiarly well to coöperative effort. There is an interesting account by F. S. Chapin in the *American Agriculturist*, from which we abstract:

The Two Rock Grange, near Petaluma, California, occupies its own hall and is a model of coöperative

enterprise. Every sixty days they order their regular supply of goods in original packages from their wholesale houses in the city, and report savings ranging from 20 to 35 per cent. Now the grange is establishing a coöperative plant for handling butter and eggs. They will put in modern creamery fixtures with store room for the egg business. Within three miles of the point selected they can secure the milk of 1,000 cows, and it is likely that there are about 20,000 chickens in the same territory. Every morning when the milk wagon starts for the creamery it will take yesterday's eggs along. All the large white eggs will be put in cases by themselves, conspicuously marked with the company's fancy brand. After dinner the wagon will take the butter and eggs down to Petaluma, to be shipped on the boat so as to reach San Francisco in time for next morning's market. As the dealer can warrant that every one of those eggs was laid day before yesterday, they will command an extra fancy price. When the wagon returns it will bring mail for all patrons, fresh meat from the butcher, small orders from the town and bones and scraps from the slaughter house. Next morning when the churn starts, these scraps and bones will be run through the bone mill and a vat of the first skimmed milk that comes from the separator will be run into curds, so that the milk wagons can take home feed for the little chicks as well as the older birds. Instead of carrying home milk for pigs and calves they will wash and scald the cans at the creamery and bring the pigs and calves there to be raised. The skimmilk calf of the olden time used to get a late breakfast of sweet milk and an early supper of morning's milk that had now turned sour. He grew up slab-sided and spindle-shanked, looking like a pumpkin seed on four pins. Here they will have a specialist to raise the young stock, who will give the little ones at least three feeds a day of warm sweet milk and the larger ones a little grain to brace them up.

Keeping Back the Fruit Buds.—F. C. Barker, of New Mexico, denies the assertion that running cold water around the roots of the fruit trees in early spring has a tendency to keep the buds back late enough to escape all danger of frosts. Experience has shown that the dormant buds throughout winter contain enough vitality at all times to blossom, and hence no amount of mulching or irrigation in winter will hold them back an hour. Indeed, so little is it believed that irrigation has any effect in keeping back the buds that some orchardists actually abstain from giving water to their trees, believing that the irrigation will hasten the opening of the buds. We believe both theories to be wrong. Trees should be irrigated in the early spring if they require it, and the buds will come out when the warm weather arrives anyhow. Neither does mulching retard the blossoming period in trees as was formerly supposed. It could have this effect only where the tree was entirely covered. In other words, placing a protection merely on the surface of the ground does not control or perceptibly influence the top of the tree with respect to the development of fruit buds and bloom. This has been abundantly demonstrated. One objection to the practice of mulching is that under a system of surface irrigation it tends to encourage shallow rooting.

An Alleged New Forage Plant.—By the Tulare, California, *Register* we learn of a plant, the "Australian salt bush" that beats the record for claims. We shall be glad to hear what Prof. Hilgard has to say of the new claimant for agricultural favor. We quote: "Mr. Forror, foreman of the culture station, has just sent to Berkeley for the purpose of analysis, a single plant of the Australian salt bush that was three feet across and weighed four pounds. This was a single plant from a single root and would make a good dinner for a sheep. We have tens of thousands of acres of land in this country that is not now worth paying taxes on that could be rendered valuable for pasturage at little cost if owners had enterprise enough to get a few handfuls of the seed and scatter it in dusty places. It does not want to be plowed in or covered up much, for if it is, the seed is apt to rot. All it requires is to get into the dust when it will take root and prosper where nothing else will. By putting a paper under a plant and shaking it vigorously the seed will be deposited on the paper and enough for a starter can be obtained in a few moments."

Dried Cream.—I have been bothered more or less with dried cream, or as some term it, windcream, in cold weather. I have adopted the plan of covering my milk, and I find clean newspapers better than dishes. I sealed my milk to prevent its getting bitter, then set in pans or buckets; buckets are the handiest for covering. When I use pans I lay a piece of lath, or a thin, narrow strip of siding across the pans to keep the paper out of the milk. I let my milk stand after setting until there is no steam arising therefrom, then cover. The paper lies loosely on the pans, and admits air enough for the milk, while it shuts out the hot air and wind. I find that I get the cream up quicker and more of it in cold weather by adding a tablespoonful of sour milk to two quarts of warm, scalded milk. Good, sour milk that is not bitter is better than buttermilk for souring new milk. I keep my cream from getting too sour by adding a little cold, scalded milk twice a day and then stir thoroughly.—*A. F. D.* in *N. Y. Tribune.*

Raising Pork on Alfalfa.—The writer has talked and written much on alfalfa pork production for the arid states, and heartily endorses the stand taken by Capt. J. P. Casey in the *Southwestern Farm and Orchard.* The captain has made it pay handsomely, as it may be made to pay in many of the arid states, not one of which yet grows enough pork to supply a tenth of the home demand. It is easy to fail by trying to succeed with scrub stock. Capt. Casey says:

"After I got pure bred Berkshires, I made double the money I did out of scrubs. I have two five-acre fields of alfalfa, so that I can pasture my hogs in one while the other rested and was being irrigated. One year I raised 385 head on ten acres of alfalfa pasture and, at fattening time, after I had fed them seventeen days on shorts and alfalfa hay they weighed from 150 to 300 pounds, dressed weight. Many of these got to 150 pounds in seven months. Shorts and alfalfa hay are, I think, quite equal to corn for giving the finishing touch to pork. The hay ought to be the first cutting and carefully cured so as to preserve all the leaves. The shorts cost me $1 per hundred pounds, and I mixed 100 pounds with 500 pounds of alfalfa hay, which should be chopped. Of course the mixture is fed wet and well mixed up. You must be careful and have a good high border between your two fields for if the water comes into the patch where the hogs are feeding they cannot resist the temptation to root into the cool moist earth. At first I had a difficulty

in preventing the animals from rooting up and eating the alfalfa roots. No amount of rings would prevent this, and ultimately I had to cut the hard gristle of their snouts, for which, you know, a special little machine is sold."

Fresh drinking water is essential, as hogs will not thrive on dirty water, any more than humans.

A Blackberry-Raspberry Cross.—E. S. Carmon, an expert hybridizer, tried long to cross the raspberry and blackberry, and while he succeeded in making the cross, yet the hybrid was worthless. A recent discovery in California seems to indicate that Mr. Carmon's failure was possibly due to the selection of parents lacking a proper affinity. Charles Howard Shinn describes in *Garden and Forest* a natural hybrid between the species, as follows:

"The Loganberry originated several years ago in the garden of Judge J. H. Logan, of Santa Cruz, from self-sown seeds of the Auginbaugh, springing up in the moist, warm soil of that sheltered district. The other parent is supposed to be a raspberry of the Red Antwerp type. Raspberries of several sorts grow alongside, and, in fact, intermingled. The Loganberry shows so clearly the mingling of both types that no horticulturist who studies the fruit has doubted that it is a true hybrid of the Auginbaugh blackberry with some large, red, European raspberry. The result is a very sturdy plant of rambling or trailing growth, needing support to be at its best, but, even in this dry climate, it is a vine of unusual substance and healthfulness, resembling the Auginbaugh blackberry, but really distinguished from it in the field. The berry is large and solid, resembling the Auginbaugh in shape and retaining its delicious, wild flavor; it is dark red to purple when fully ripe, and shows its texture in the easy slipping from the core, and partly in flavor the raspberry parentage.

Tests made in different soils and in some very dry situations have shown, so far, that the Loganberry will grow and bear a fair amount of fruit in localities where the gooseberry, currant, high-bush varieties of blackberries and dewberries have entirely failed. As I have said, plants of *Rubus ursinus* are sometimes found thriving very well on dry hillsides, with scrub oak and chaparral, but seldom bear fruit to any extent in such arid places. In other words, some individuals of this variable species of Rubus grow in very hot, arid and barren places, and the original Auginbaugh, though found on a sandy peninsula, near the bay, instead of on a hillside, seems to have had the power to transmit this resistant quality, together with an increased productiveness. The Loganberry is now grown for market, and the results are said to be gratifying, both in regard to price and yield.

Grape Trellising.—T. V. Munson, of Texas, has done much for grape culture. His system of trellising is a minor item of his work, but a very important one. It has been the subject of comparative tests at the Oklahoma Experiment Station, and has proven so successful that Prof. Waugh unhesitatingly recommends it for general adoption. In this system the posts stand six feet out of the ground. At the top a cross-piece, two feet long, is nailed, and at each end of this a wire is run. A third wire is run through the middles of the posts eight inches below these two, so that the three wires set in a sort of a broad V-shape, nearly six feet from the ground. This great height is an essential feature of the system, and should not be modified. On this trellis the grape vines spread out like they do where they grow wild in the woods. This furnishes a shade for the fruit. At the same time the fruit is so far above ground as to be safe from the intense reflected rays of the sun, which is apt to cause damage in the hot summers of the arid region.

Operating Incubators.—The following condensed rules are from the Standard American Poultry Book:

1. Keep the temperature as near 103 degrees as possible.
2. Turn the eggs twice a day.
3. Cool them well once a day.
4. Place wet sponges in the egg drawer from which to impart moisture.
5. Avoid handling the eggs, use gloves if necessary.
6. Allow plenty of ventilation in the room where the machine is operated.
7. When the chicks are coming out do not open the drawer, as cool air then is injurious.
8. Let the chicks dry well before removing them to the brooder.
9. Select eggs only from strong, healthy stock, rejecting those that are very small, very large, misshapen, or otherwise imperfect.
10. Keep strangers away, especially if they wish to inspect the egg drawer.
11. Have regular hours for doing all the work.
12. Do not believe that a child can manage it.

Persons beginning with incubators will probably have little success in operating them at first, but should not become discouraged. No one can take a new machine and run it successfully until he has learned to manage it. Regulating the heat and amount of moisture can only be learned by experience.

Root-pruning acts like magic sometimes in bringing barren trees into bearing state, especially when unfruitfulness is brought about by undue luxuriance. When trees are making very strong shoots they are found on examination to be making roots in proportion, and so long as this goes on fruit prospects are very much jeopardized. Every observing fruit grower knows of orchards that are not doing their duty for this very reason. It is the small, fibrous roots which command the formation of fruit spurs, and in some soils there is difficulty of maintaining a fruitful condition. In orchards where the surface is light and open, with a clayey subsoil, there is a great tendency for the roots to go deep in search of moisture, especially if the aspect is at all open or windy. With soils of this description mulching is of considerable value, of no matter what kind. The trees should be examined for a big tap-root and if such be found it should be given the chisel, for if left to remain the tree will be a shy bearer.—*Field and Farm.*

A Valiant Woman Worker.—Could every State of Arid America have in Chicago such a representative as Washington has in Mrs. Alice Houghton of Spokane, who also won brave laurels in the women's department at the World's Fair, then those States would be well represented indeed. Mrs. Houghton lately delivered an able lecture on Washington to an audience which nearly filled Central Music Hall, and she wins friends for her State by tens and scores and hundreds. Her successful deals in real estate win the respect and admiration of her sharpest male competitors. Yet withal, she is a womanly woman, always a lady, genial, easy and approachable.

THE QUESTION BOX.

The Question Box shall be an "open parliament" for the discussion of the practical, every-day questions that perplex the irrigation farmers. Questions will be answered by those men of long experience among our readers who are glad to give of their knowledge for the common good. Further answers are solicited from any reader whose experience differs from that published here. The editors reserve all rights of control of the department.

Crops for Young Orchards.—A. D. T.—Please inform us new beginners what hoed crops may be grown at a profit in a young orchard. How about strawberries? May other roots than potatoes be cultivated without harm to the trees?

Almost any cultivated crop may be grown with profit in the spaces between young fruit trees, so far as the trees are concerned, if the ground is kept properly enriched, which it should be for the sake both of making profitable the crop grown and keeping intact, or augmenting, the stores of nutriment necessary for the growth of the trees and their future harvests of fruit. Strawberries answer the purpose admirably. We know of no root crop that will harm the trees in the least if that which is taken from the soil by the crop is faithfully made good by manuring, fertilization and cultivation. Don't make the mistake of supposing that you can get paying returns of a series of any sort of crops off a piece of ground, and at the same time have it grow thrifty trees, finally loaded with big apples, without giving the soil something out of which to produce the desired results. This has been tried often enough to dispense with necessity for further experiment along that line. The form of inquiry indicates that our correspondent is aware of the fact that small grain should not be used as an interculture in such case. Alfalfa is also undesirable.—J. W. GREGORY, Garden City, Kansas.

Cultivation vs. Irrigation.—J. C. V.—Some farmers claim that thorough cultivation, and two or three irrigations during the season is better than more irrigation. (1) Is this true of potatoes? (2) Of what kinds of fruits is it true? (3) State approximate number of times for cultivation, and likewise for irrigation in each case. (4) How late should deciduous fruits be irrigated? and (5) how early in spring?

(1) No, it is not; potatoes, as a rule, should be irrigated at least once a week until their maturity, then no more. (2) Of no kinds. All fruits require irrigation, especially during the hottest part of the summer. (3) Cultivation ought to follow each irrigation as soon as the ground is in a fit condition. Cultivation should be once or twice a week. (4) Deciduous fruits should be irrigated until they are well matured, and just before and during the ripening season; if the weather is hot they require more thorough irrigation. Any intelligent farmer will soon learn when to irrigate, and how long to keep it up each time. Every farmer knows about when he would like to see it rain. Instead of watching the clouds and praying for it to rain, if he is prepared to irrigate he can answer his own prayer.—N. G. BLALOCK, M. D., Washington.

About Small Ditches.—C T. N. and Others.—What is the capacity of small ditches at different grades? Reference is made to the farm laterals. What method of management of ditches is most economical of labor to keep them in order and distribute the water?

A fall of one foot in a hundred feet is as much as is usually needed, and will give a velocity of two or three feet per second in farm furrows, depending on how much *smoothing* is done with hoe or drag, and this is as fast as the water will run without washing. Less fall gives less speed about in proportion. The capacity in cubic feet per second is found by multiplying the water area in square feet by velocity in feet per second. Main lateral along farm fence should be made permanent and should be broken, for taking water out, at points only. Small laterals may be torn away as fast as land is watered, beginning at the farther end. In general, laterals are built up so that the water is above ground.—H. V. HINCKLEY, C. E.

A miner's inch is sufficient to irrigate an acre of arid land well, and of semi-arid land two acres or more. The lateral should be run on the highest ground on the farm, or, if a ridge or "hog back" runs through the farm, the head ditch should run on it and then irrigate both ways from it. The best and most economical way to get water out of this head ditch is to make boxes of 1¼ inch lumber, four inches square inside and four feet long, with slide gate in one end. Place this box in the bank of the ditch so that the open end of the box is on a level with the bottom of the ditch, cover the box, pounding the dirt around the box so that the water will not cut through along side of box. Having ground prepared and ditches run, you raise the little gate and allow just as much water to escape as you want. These boxes should be placed about one to two rods apart. Sow blue grass along the bank of your ditch over these boxes and you will soon have a beautiful sod, which will not break. I have 400 acres prepared this way and one man, who boards himself, irrigates the entire 400 acres and does it well for $1.00 per day. This land is nearly all in orchard, and all in fruit trees, vegetables and meadow. I irrigate from one to three times per week, according to the season. Two hundred to four hundred yards is as long as irrigation ditches should be made. Make other head ditches and boxes in the first place. Another way is to build a flume for the head ditch and simply bore auger holes every rod or two, instead of the small boxes.—Dr. N. G. BLALOCK.

Irrigation Literature.—W. H. F.—What are the latest and best engineering works on irrigation for the use of engineers?

The Eleventh Annual Report of the U. S. Geological Survey devotes forty-four pages to an index of Irrigation Literature. See part II. (or Second Annual Irrigation Report), pages 345 to 388. See also sundry articles in THE IRRIGATION AGE for 1894 and bulletins Number 22 and 27 of the State Agricultural College, Ft. Collins, Colo., on water duty and measurement.—H. V. HINCKLEY.

Herbert M. Wilson's "Irrigation Manual," published by John Wiley & Sons, New York City; P. J. Flynn's "Hyraulics" for sale by Mrs. P. J. Flynn, Los Angeles, California, and Butler's "Manual" treating of the artesian well supply of South Dakota, for sale, by C. D. White of Huron, may also be mentioned.

ELECTRICITY AND WATER POWER.

FAR-SEEING minds make highly attractive the project of using the water of mountain streams, and of falls in irrigation ditches, for the generation of electricity for power and light, before it is spread upon the fields, without a drop of loss or infringement upon its use for irrigation. In this prospect there is not only the question of power for large and small manufacturing establishments, but also, and perhaps of equal or greater importance, the revival of the system of home industries that made old New England self-supporting, and which the small diversified farm, conducted on the family sustenance plan, independent of markets, is looking toward as the logical outcome of that system. Thus did the early Utah settlers live and thrive, bu without the powerful aid of the electric motor. With the irrigation ditch, or its reservoir or river source, also supplying the power for electric motors for the runing of the churn, the saw, the thresher, the grinding mill, the sheller, the house elevator, the hay press, the stack builder, the fodder cutter, and also the sewing machine, the knitting machine and perhaps the coming home loom and spinning wheel, etc. Political economists tell us that the salvation of the home idea, and perhaps of the nation, may rest in the keeping of the boys and girls at home by means of the regeneration of the old system of home manufactures. Heretofore the cost of power, in competition with the great factories, has been an unsurmounted obstacle. But in the low cost, small electric motor, lies a possible solution of the interesting and important problem.

Six years ago the total electric railway mileage in this country was but forty-eight miles, distributed among eight different States. But so remarkable has been the development of the means of successfully applying electricity as a cheap and efficient motive power, that by the close of 1893 over sixty per cent of all the street railways in the United States were operated by means of electricity. The horse as a motive power on street railways is surely on the road to extinction, for almost everywhere the lightning has overtaken him and driven him from his former field of usefulness. But this is in no wise to be regretted. The new appliances serve the public much more efficiently and the fate of the car-horse has always been a cruel one.

In San Antonio canyon, in San Bernardino county, California, is quite an extensive electric plant, conveying power to Pomona and San Bernardino. The power station has four double-nozzle Pelton water wheels, thirty-four inches in diameter, coupled to the armature shafts of four Westinghouse alternating current generators of 200 horse-power each. The current is carried on two wires to a point seven miles down the canyon, where the wires diverge. One runs to Pomona, a distance of fifteen miles, and the other to San Bernardino, twenty-eight miles, covering in the latter case, with the return circuit, a distance of fifty-six miles.

By means of transformers the potential is raised at the generating station to 10,000 volts, and the current carried at this pressure to sub-stations located just outside each of the cities named, where, by means of "step-down" transformers, it is reduced to about 1,000 volts, and then distributed for light and power purposes.

The Clear lake project involves laying a wire seventy-two miles in length from a point on Cache creek, Lake county, to San Francisco, with branches to intermediate towns. Except for irrigating purposes the water of Clear lake is useless. The lake has an immense watershed, with a heavy annual rainfall. It is estimated from careful measurements taken at various seasons of the year that the outflow from the lake is sufficient to generate, through motors, twenty-five thousand horse-power which could easily be doubled by the erection of dams. This would supply about three-fourths of the power now used daily in manufacturing establishments in San Francisco.

NEW PROCESS IN IRON PRODUCTION.

The French Consul at Hamburg reports the new German process for employing electricity in the production of pig metal and of the metallurgical work generally. The fusion and casting is effected in an apparatus comprising the smelting furnace and models with the object of obtaining a casting force from pores and blisters, the gas and air being expelled by an air pump during the operation. The electric current which causes the fusion does not affect it from the outside through the walls of the crucible or furnace, but by the metal itself conducting the current through the mass. In the production of crucible steel the new process, it is said, showed a saving of one-half the fuel. The iron obtained in this way is very pure containing, according to the Berlin Academy of mines, only 2.99 per cent. of carbon owing to the fusion being accomplished without the use of coal or coke.

ELECTRIC DELIVERY WAGONS.

Trial has recently been made in London of an electrical parcel van, which, as described by the New York *Recorder*, does not differ greatly in outward appearance from other vehicles of the same order. The interior of the van is left free for goods, for the two motors, which are geared to the wheels, are placed beneath the driver's seat. The electricity is derived from 36 cells, which are carried under the body in a special box, and so arranged that they may be charged in two minutes when the accumulators are exhausted. With his left hand the driver, by means of a single switch, regulates the speed of the van, which, if necessary, may be as high as fifteen miles an hour. The right hand is free to turn a steering wheel, which is provided with a pointer, indicating the direction in which the vehicle is going. As the steering gear has ball bearings, the conveyance is under perfect control with a minimum of effort.

Utilizing Waste from Street Railway.—A Brooklyn merchant says he keeps his office cool with an electric fan which is operated by the waste electricity from the trolley railway in the street. One of the wires is attached to the gas, the other to the water pipe connecting with the street mains, and these are charged with the "grounded" electricity from the rails of the trolley road.

It is possible to plant out a peach orchard for a quarter the money an orange orchard costs and to make it yield as big a revenue in half the time.

PULSE OF THE IRRIGATION INDUSTRY.

THE TEXAS CONVENTION.

THE Texas Irrigation Convention, held in San Antonio early in December, 1894, was a remarkably successful one. Delegates from every part of the great state of Texas were in attendance, and demonstrated by their words and actions that they were broad and liberal-minded men, capable of giving the subject of irrigation the attention which it deserves. One of the prominent features of the convention was the urgent demand for state legislation in favor of irrigation. In many of the counties of western Texas canals and reservoirs have not been built because the land is owned in alternate sections by the state, school and university funds, and by railroads or individuals. If the state would consent to consolidate some of these holdings at the instance of railroads or individuals, it would make possible the installation of extensive irrigation systems. Another important feature was the demand for the appointment of a state irrigation committee, and an engineer to make a survey of the water supply and geological conditions. A committee was appointed to bring this matter before the state legislature at the earliest possible moment. It was shown that the present laws were inadequate, and new laws must be enacted at once if Texas hoped to take her rightful place among the leading states of Western America. Resolutions were also adopted advocating an international treaty between the United States and Mexico, in order that the water in the Rio Grande, which is now practically going to waste, might be utilized. Many good speeches were delivered and aroused much enthusiasm. They covered the subject in all its various phases.

In his paper on "Some Sources of Water Supply in Western Texas," Prof. Dumble showed that Southwestern Texas is well supplied with drainage channels and water courses. It contains parts of four river systems: the Colorado, Guadalupe, Nueces and Rio Grande, and that the water supply was sufficient, if properly utilized, to irrigate the greater portion of the territory.

In a long and able address, Major C. E. Dutton of the United States Army reviewed irrigation laws in many of the Western States. He compared Texas at the present time with California twenty-five years ago. The rights of appropriators and the rights of riparian owners were constantly clashing. In California this had been overcome by the law of eminent domain, which allowed the right of way for canals to be condemned and the diverting of the water of streams into them to be used by the public for irrigation purposes.

A long and interesting paper from Henry Scougall, C. E., of Mexico, was read. He compared the fertility of the soil in the valley of the Rio Grande with that of the valley of the Nile in Egypt and rivers in India, in which countries he had for many years been engaged in irrigation work. He advocated the cultivation of Egyptian cotton and Egyptian corn, referring to the latter as a "good and sure poor man's crop."

The water supply from artesian wells was touched upon by J. D. Whelpley, who mentioned a well upon the Kampmann estate, a few miles from San Antonio. The well is 800 feet deep, and supplies one million and a half gallons of water daily. The artesian supply in some parts of the western portion of the state is not considered sufficiently great to irrigate any large bodies of land, although in nearly all cases the wells would furnish enough water for use on the small farms.

A permanent organization was effected with the title "Texas Irrigation Association," and General F. M. Clarke of Fort Worth elected president. General J. H. McLeary and Chas. C. Pierce were elected vice-presidents at large, and Edwin Chamberlain of San Antonio, and J. N. Brown were elected secretary and treasurer, respectively. Vice-presidents from each of the Congressional Districts were also elected. The next annual convention will be held in San Antonio, Tex., on the second Tuesday in November, 1895.

NEBRASKA IRRIGATORS.

A LIVE convention of earnest Nebraska farmers organized at North Platte recently a big association for the salvation of their industry by irrigation. Some 1,800 names are now enrolled in the membership lists. President Fort's address was the leading feature, and we gladly quote some of its salient points, regretting lack of space for it entire. Irrigation, said Pres't Fort, has become a leading topic of discussion, and as Nebraska must even remain almost an exclusively agricultural state, the industry must be supported with intelligence. A state irrigation commission is demanded, and the state experiment station must give irrigation most careful study. Stoppage of prairie fires and promotion of forestry are intimately connected with irrigation. By comparison with Colorado, fully 60 per per cent. of our lands may be irrigated, allowing for all methods of irrigation—the canal, the various pumping systems and sub-irrigation, and fully five million of acres may be economically irrigated within the next ten years. In the streams and the available underground water the supply is ample for all these lands. A large proportion of Nebraska irrigation will be by pumping. The cheapest form is the Chinese system of "sliding water up hill" in a trough with paddles on an endless chain or rope. Horse, wind, steam, or any other power may be used for this home-made contrivance.

Probably the cheapest power that can be obtained will be the water itself, and hydraulic rams where a light fall can be given so as to work these machines will deliver water cheaper than any other class of water lifting appliances. The bucket elevators are claimed as cheap and efficient.

The centrifugal and rotary pumps will lift large quantities of water cheaply. They are not liable to get out of repair provided a strainer prevents chunks of wood or gravel from getting into the machine. Either will lift sand, mud or fine grrvel, especially the centrifugal. As they are not liable to get out of order and have but few working parts, they are to be recommended as good machines for lifting water. They must, however, be worked at a high speed to

secure the best results and must theretore be attached to gearing.

Probably the cheapest and most economical water-elevator is the current wheel. This has one set of stationary buckets or paddles that are struck by the current of the river or creek, that turns the wheel and a set of adjustable buckets fill with water as they revolve and on reaching the highest point are tipped automatically and the water is discharged into a trough which conveys it to the land.

It is doubtful if any cheaper power will be discovered for lifting water than the water itself, unless it be the wind. Now that inventors have secured by proper construction of the frame fully eighty per cent. of the pressure applied by the wind to the mill's surface, the prospect of a cheap power for lifting water is favorable, and we can hope that within a few years that every farmer will own and have at work one or more of these machines, that will be lifting water into reservoirs, from whence it can be carried out over his garden, orchards and fields, and in this way safely solve the food question for all parts where the canal may not go.

But too much should not be expected from irrigagation. So far the business has not justified in any of the states the expenditure of any great amount of money for water for field crops. Irrigation as a means of securing every year a sufficient food supply from the soil of Nebraska has become imperative. Three, five or even ten acres of land irrigated and well and intensively cultivated, a sufficient food supply can be obtained, and it is safe to say that the few acres well tilled and well cultivated will be the successfully irrigated farm. Do not want to rush wildly into the contracting of 80 or 160 acre water rights. We shall do better with five or ten acres for the first few years.

Wherever practical, the canals should be constructed, owned and managed by the farmers themselves. In Utah fully 90 per cent. of the canals have been constructed by the Utah farmer, who owns, manages, and controls them. This places land and water under direct control of the farmers themselves, making land and water inseparable. In Colorado 95 per cent. of the canals have been constructed by the farmers and from 90 to 98 per cent. of all the canals of the west, with the exception of some of the very largest, have been built by the farmer and this without bonds or foreign capital.

We do not favor the voting of bonds to private corporations for canal construction.

A CALIFORNIA ENGINEER.

PROMINENT among the irrigation engineers is H. Clay Kellogg, a native son of California, who came to Anaheim in 1869, the first colony in the State where irrigation was successfully practiced. Here as a boy assisting his father on the farm he acquired a knowledge of the value of irrigation, and saw that it would be a good opening for any one who would devote their attention to it, hence in his college course he made a specialty of engineering and hydraulics. During the last three years of his course he did considerable surveying, which afforded a good opportunity to put theory into practice; but he did not take up the practice of engineering as a business until three years later, in 1881. The first work of any magnitude was the laying out of the town and colony of Elsinore in 1883. On the organization of the Anaheim Union Water Company, in 1884, he was made their engineer, and subsequently he was appointed their superintendent of construction, which position he held until 1886, when he accepted the position as surveyor for the South Riverside Land and Water Company, laying out their town and colony in 1886-7. He was made engineer of their water system in 1887, and has charge of their work in that line ever since. In 1888 he built the Southern California Motor Railway from San Bernardino to Riverside. In 1889 he was appointed engineer of the Anaheim Irrigation District, and made all their preliminary surveys. In 1892 he planned and superverised the construction of the inverted siphon in the Orange canal for the Santa Ana Valley Irrigation Company. This is a concrete conduit seven feet inside diameter, constructed in the bottom of the old tunnel; also nine miles of 24-inch pipe line over a rough mountainous country, containing fourteen inverted siphons, for the South Riverside Company during the same year. In 1893-4 he was constructing engineer for the Peoria Canal Company in the rebuilding of their dam across the Gila river at Gila Bend, A. T. The dam was completed on June 30th of 1894. The water ran over the top of it on August 10th, and has been passing over it quite liberally ever since, and is a monument demonstrating the character of the work performed. Mr. Kellogg has just been elected County Surveyor of Orange county, where there is a good field for the exercise of skill in river improvement. All the works constructed by Mr. Kellogg are in successful operation, and the towns and colonies of Elsinore and South Riverside are becoming large and thriving places, and his standing as an engineer in those communities is an evidence of his ability.



H. CLAY KELLOGG,
Of Anaheim, Cal.

HEALTH IN IRRIGATED VALLEYS.

SOME queer inquiries come to the editor. Among them, to one who sought and found new health and strength in the irrigated valleys of the arid regions, the questions about the healthfulness of irrigation come with special force. One California land company sends out pamphlets charging that irrigation is unhealthful, in order to sell their own lands, which they claim do not need irrigation. Yet on another page of the same pamphlet they explain how the *gardens* of the settlers on their lands are supplied with water for irrigation by pumping! Interested inquirers will read with satisfaction the following from the pen of Dr. Henry W. Roby, which we find in the pages of the *Kansas Farmer*:

With the proper sanitary precautions all along the line, the effect will be beneficial rather than otherwise. But with careless habits and unsanitary conditions, the effect will be the decimation of population. With an extensive establishment of irrigation works, so that a considerable percentage of a large area is brought under the influence of the system, the atmospheric and magnetic conditions will be radically changed. The prevailing dry atmosphere will be displaced by a prevailing humidity, which will have special effect on the human system. Those cases of bronchial and pulmonary catarrhs, with incipient consumption, which heretofore have found asylum and sanitarium on our Western plains, will probably need to 'move on' to some dryer place. But as drought has its disease-breeding tendency, as well as humidity, it will but work an exchange of compliments.

Clean, pure water is never unwholesome or dangerous to health. Millions of people live long and well on the water or close beside it, and they show as good health records as those who live remote from water. But let the water in lake, river, pond, creek or pool become stagnant and filled with dead and decaying animal and vegetable matter, and then disease and death come marching in. With a good, clean and well-kept pond on every farm, only beneficial effects may be expected. But let the pond become stagnant, and dump into it all the dead cats and dogs and chickens; all the old shoes and hoopskirts and other rubbish that accumulate about the place; let the pump get out of order and remain so until the hot sun evaporates nearly or all the water in the pond; let leaves and weeds and grass rot in the shallow basin, and death will claim its own. The grinning skeleton on the pale horse will thrust in his big scythe and reap the dread harvest that your McCormick reaper has passed by and left untouched. Let your cows and horses and pigs and chickens wade into and trample your pond and drop manure all about its margin to putrefy and reek in the hot sun, and a coffin will not come amiss among the family supplies. If you allow your barn-yards and privies and cesspools to drain, or in the rainy season wash into your ponds, then you should have your doctor and undertaker employed by the year. If you will keep your pond full of living water, and keep it in motion by keeping the pumps going, filling the pond at one side while it overflows at the other, and see to it that no refuse from house or barn, no rubbish, no dead animals or leaves or grass foul the pool, you can hang the American flag over your lakelet and raise the shout of victory.

Probably the best countries in the world in which to study the relations of irrigation to health are Egypt, India and the Island of Ceylon, though the empires of China and Persia have spent mints of money on irrigation, but have no mortuary records.

The Nile valley swarms with a dense population, but the living water of the Nile on all the water meadows of Egypt and in all its aqueducts and ditches brings only the rose tints of health to its inhabitants.

The vast rice fields of India, flooded from the Indus, the Ganges and Brahmapootra and many other great rivers, are only unsalubrious when they receive the offal and excreta of towns and cities or other dense centers of population.

Sir Emerson Tennent, the most careful and voluminous writer on Ceylon, where the most gigantic irrigation works in the world, in the way of ponds, pools, tanks and lakes, have been erected and maintained for hundreds of years, tells us that round about all the great tanks, some of them many miles in extent, and filled from rushing rivers and mountain streams, the highest degree of health prevails. He says: "The vast, level plains, whose stagnant waters are made available for the cultivation of rice, are seldom or never productive of disease." It is even believed that deadly air is deprived of its poison in passing over an expanse of still water.

LIGHTNING STATISTICS.

Recent researches by the U. S. Weather Bureau lead to the announcement that for the period of five years—1883-87—the number of deaths in the United States by lightning reached 1,030, a yearly average of 206. In 1890 the number was 120; 1891, 203; 1892, 251; and in 1893, 209. From 1885 to 1892, inclusive, the number of fires caused by lightning was 3,516, involving a loss of $12,663,835. Most of these losses occurred east of the Rocky mountains. During nine years ending with 1892, 2,335 barns, 104 churches and 664 dwellings were struck by lightning in the United States. It is of interest to note that of the 1,921 fires caused by lightning during the years 1890-91-92, only one occurred in California; and of the $5,781,310 lost by such fires, only $2,000 is credited to California. With regard to the likelihood of trees being struck, the oak is most liable and the beech least in danger of being hit by lightning. Representing the frequency with which the beech is struck by 1, the pine would be represented by 15, the general average of other trees 40, and the oak 54. A belief prevails quite largely among farmers that it is cheaper to insure against lightning with some of the reputable insurance companies than to seek protection by mechanical appliances. The researches of the Weather Bureau do not confirm this view. Besides the losses by fire, which might or might not in a given case be made good by the insurance companies, there remains the loss of life, which cannot be thus compensated. In brief, then, the best authority we have on this subject recommends the use of lightning rods as a measure of protection, though of course absolute immunity cannot be guaranteed in this or any other way. But good rods, properly erected and kept in repair, are found to afford a large measure of protection against lightning. In this connection it may be of interest to cite the result of investigations made in Belgium by Evrard and Lambotte, and published in 1891 in *Ciel et Terre* (Heaven and Earth).

These careful investigators found that of 324 flashes of lightning in 1889, in Belgium, only two struck lightning rods; 123 struck unrodded buildings, setting 36 on fire; 16 struck persons; 96 struck trees; 81 struck telegraph and telephone lines. Further, it was found that of 18 deaths caused by lightning, one occurred within a dwelling, 11 out of doors and six under trees.

The Weather Bureau strongly recommends that all barns and exposed buildings be provided with lightning rods. Good iron or copper rods may be used. If copper, the rod should be in form of a tape and should weigh not less than six ounces to the foot. If iron be used, and it appears in every way as efficient as copper, it may be either in the form of rod or tape, but should weigh 35 ounces to the foot. The ground end of the rod should in all cases terminate in moist earth or in water, and the top must be always protected by plating or otherwise against liability to rust or corrosion. Chain or linked conductors should not be used. Lightning rod manufacturers and agents often claim absolute protection by their rods within certain limits, proportional to the height of the points above the ground. The investigations of the Bureau lead to the following announcement in this connection: "We now hold that there is no such thing as a definite protected area." With reference to the efficiency of lightning rods when properly placed and cared for, the report of the Bureau cites the case of the Washington monument, which was struck in 1885. It appears that the rodding was somewhat defective originally, but changes were made after the damage of 1885, and of present conditions the Bureau report says: "Eight years have now passed since the alterations were made and the monument stands unimpaired. Unquestionably, standing as it does, 555 feet high, in the center of flat, well-watered ground, it constitutes a most dangerous exposure for lightning flashes. No better illustration of the value of lightning conductors can be asked."

TRAVELING CABLEWAYS.

Mr. Spencer Miller, engineer of the Lidgerwood Manufacturing Company, New York, Chicago and Boston, will soon be in the West for the purpose of bringing to the attention of parties interested in irrigation matters, the merit of the Lidgerwood Traveling Cableway in the construction of irrigation and waterworks dams.

This machine has received the hearty endorsement of engineers and contractors familiar with the problem of hoisting and conveying large stone in such work profitably and expeditiously, and in its present form is shown in a high state of simplicity and efficiency. Mr. Miller is a member of the American Society of Civil Engineers and widely known for his work in the development of the traveling cableway.

AN ENERGETIC SUBSCRIBER.

Montana is wide awake to the importance of irrigation as a means for the development of the agriculture of her splendid valleys. Mr. J. C. Burns, of Chinook, in sending us a list of fifty new subscribers, writes: "This valley, along the Milk river, extending some 140 miles in length and two to seven miles in width, is one of the best valleys in the west. It is, however, comparatively new, having been opened to settlers about six years ago, having been a part of the Assinaboine Indian Reservation. I came here in March, 1889, from the Yellowstone Valley, which is described in the December AGE. There are many good locations in this country for home seekers, and we need them to help build up our industries. We know that the influence of THE IRRIGATION AGE has been to encourage and aid the development of the new sections of the west, and we feel that it is aiding and assisting in the upbuilding of agricultural and irrigation enterprises, and we want to call attention to some projects that would be of great benefit to this magnificent valley. One is the turning of some of the waters from St. Mary's Lake into the head of Milk River for the increase of our water supply. The government has already had this surveyed by engineer Nettleton, who made a favorable report." THE AGE is always glad to publish authentic information concerning any honest enterprises, projected or in operation, which are for the development of any part of the great western country.

THE SACALINE SEEDS.

Many calls are being received for the packets of sacaline seeds which we are offering to prepaid subscribers to THE AGE for 1895. None will be sent out except upon application, as they are too costly to be wasted. The seeds will be forwarded late in February or early in March, in ample time for planting.

UTAH ENTERPRISE.

One of the handsomest folders that has been published by an irrigation company is just issued by the Bear River Irrigation Company, of Corrinne, Utah. It has evidently been prepared to give brief, concise answers to every question which a prospective settler can think to ask. It is illustrated by more than a dozen full-page half-tones, some of them combinations representing a number of views together. On the one side is an accurate map of Northern Utah showing the close relation which these fine lands bear to the cities of Salt Lake City and Ogden, getting advantage of these home markets, as well as of the populous mining regions of the Territory. It will be sent on application as above.

Mr. F. C. Finkle, Chief Engineer of the Grapeland Irrigation District, says they are progressing well with their canal and tunnel. There are now eight miles of canal completed and 2,050 feet of the tunnel. The flow of the water is increasing rapidly in the tunnel, and by the time the remaining 950 feet are completed it bids fair that the flow of water will be greater than expected.

The Citrus Belt Irrigation District have begun construction on their main canal, having made a start about the middle of November. They have about half a mile excavated and one-quarter of a mile cemented at the present time, Mr. Finkle is still chief engineer for both the Grapeland and Citrus Belt Districts.

Messrs. Phillip Bros. have just completed the platting of their 640 acre ranch west of Las Animas, Colorado, under the Riverside ditch, into 20 and 40 acre tracts, which they will put on the market in the spring. The place is laid out with broad roads and numerous driveways and will be known in the future as Riverside Park. Although this land already has

an abundance of water from the Riverside ditch, a reservoir will be built to further insure it. By this means a person with but 10 or 20 acres can, in drawing his water from the reservoir, use as large a head to irrigate with as though he owned a water right for a whole section.

The Consolidated Home Supply Ditch and Reservoir Co. of Larimer County, Colo., are constructing a solid masonry dam, 59 ft. in height, across the Big Thompson Creek, opposite the head of their canal, with J. H. Nelson, engineer, in charge. A height of 27 ft. has been reached, and unless winter should prove too severe early completion is expected.

The Union Oil Company has commenced operations for the sinking of a number of wells on the property leased from J. Sansinena, about five miles north of Fullerton, California.

The Anaheim Irrigation District, of California, was voted out of existence. It is estimated that the organization cost the farmers of Anaheim, Fullerton, Placentia, Yorba and other places about $50,000.

A canal, large enough to carry water to irrigate 3,000 acres of land in the vicinity of North Yakima, Washington, has just been completed. The water will be taken from the Natchez river and carried eight miles, finally being emptied into Wide Hollow creek. It was through the enterprise of Mr. Chester A. Congdon, of Duluth, Minn., aided by the efforts of ames M. Gilbert of North Yakima, that definite steps were finally taken to construct the canal.

Weather observer Beals of Minneapolis, Minnesota, recently read a very interesting paper before the State Horticultural Society. He reviewed at length the rainfall record and admitted that irrigation was the solution of successful agriculture of the future and also that it would be of benefit to Minnesota at the present time.



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IRRIGATION ENGINEERS.

List of new members and changes of address of old ones as reported by John S. Titcomb, 36 Jacobson Building, Denver, Colo., the secretary and treasurer of the American Society of Irrigation Engineers.

NEW MEMBERS.

King, Fred Edward, Civil and Hydraulic Engineer, Florence, Colorado, Sept. 13, 1894.
Murphy, Edward Charles, Asst. Prof. of Engineering, University of Kansas, Lawrence, Kan., Sept. 13, 1894.

LATEST ADDRESSES.

Bell, Henry P., Victoria, British Columbia.
Boggs, Edward M., Territorial Engineer, Tucson, Arizona.
Collier, R. E. Lee, Fillmore, Utah.
Fox, Geo. B., Teviston P. O., Cochise County, Arizona.
Hallihan, John P., Toyah, Texas.
Hardesty, Wm. P. C., 612 Progress Building, Salt Lake City, Utah.
Hawkins, Erastus C., 302 S. 14th St , Denver, Colo.
Hinton, Richard J., The Maywood, Bay Ridge, N. Y.
Hills, Victor G., Cripple Creek, Colorado.
Kinney, Edward C., 145 S. Lincoln Avenue, Denver, Colorado.
Kittell, A. P., North Platte, Nebraska.
Lippincott, Joseph B., 205 Thayer Block, Kansas City, Mo.
Martin, Edmund P., Engineer, Public Works, Denver, Colorado.
Nettleton, Edwin S., 3028 Main Street, Kansas City, Mo.
Parrish, Augustus L., Roswell, N. M.
Philbrick, Arthur, Baker City, Oregon.
Ray, Nathaniel, Coulterville, California.
Reed, Wendell M., Roswell, N. M.
Robinson, John H., Colfax, Colorado.
Rockwood, Charles R., 931 S. Hill St., Los Angeles, Cal.
Salter, R. R., La Junta, Colorado.
Schuerman, Wm. H., Vanderbilt University, Nashville, Tennessee.
Schuyler, James D., 1484 S. Flower St., Los Angeles, California.
Scougall, Henry, 8 Galle Gante, Mexico City, Mexico.
Stanton, Robert B., 509 W. 23d St., Los Angeles, California.
Starbird, George A., 2130 16th St., Highlands, Colorado.
Stevenson, Benj. R., Wisdom, Montana.
Stevenson, Chas. C., Boise City, Idaho.
West, George H., Railroad Building, Denver, Colorado.

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L. R. BRITTON, Business Manager.

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EDWARD EVERETT HALE,

The great citizen of Boston to whom Western America is indebted, more than to any other man, for the generous reception its cause has received in New England.

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THE IRRIGATION AGE.

VOL. VIII. CHICAGO, MARCH, 1895. NO. 3.

THE PROGRESS OF WESTERN AMERICA.

The Country Begins to Listen. The American people have begun to listen. It has taken a good deal of time, much hard work, and very persistent effort, but the ice has been broken and the work of conversion begun under the most encouraging circumstances. The country has hitherto thought of irrigation as the peculiar problem of a remote and rather unpromising portion of the United States. This year's work of the National Committee is directed to an effort to make the country see the relation between the irrigation empire and the economic problems of Eastern America. It is with very great pleasure that THE IRRIGATION AGE reports progress for the committee in this great undertaking. No man who has not attempted such a public work can begin to appreciate the difficulties in the way. It is hard enough to get the public to listen to a new idea of any sort. It is immeasurably harder to induce the public to give a fair hearing in a matter where prejudice amounts almost to bitterness. The people of the East have lost much money in Western investments. During the past few months their morning newspapers have fed them with a steady diet of calamities which have overtaken farmers in the West. They have been called upon to send money, provisions and clothing to relieve the urgent necessities of unfortunate people who have settled in certain States. Under these circumstances it has required a considerable degree of courage and patience to obtain a hearing for a proposition which calls upon the East for men and money, and for both in unlimited quantities.

God Bless Boston. God bless Boston and New England! Many a great cause which has elsewhere appealed to deaf ears has knocked at the door of Boston, found ready admittance, and been invited to sit down and warm itself at this generous fireside. So it has proven in this case. The chairman of the National Committee did not find it necessary to remain in Boston more than three days before the hearty support of its leading men and newspapers was secured. And this speedy result is principally due to that famous author and divine, that great-hearted friend of humanity — Edward Everett Hale. Dr. Hale has long been of the opinion that the surplus people of the East must be transferred to the surplus lands of the West, and there rendered independent by a scheme of industry capable of indefinite expansion He was thus anxious to ask only, "What can I do for your cause?" His letters of introduction resulted in the publication of conspicuous newspaper articles, quickly followed by a meeting of the most prominent citizens of Boston, and to be followed this month by a mass meeting. The *Boston Herald* of February 17th, devoted two columns to a vigorous and enthusiastic presentation of the irrigation idea. Its managing editor, Mr. John H. Holmes, immediately tendered the cordial support of his greatly influential newspaper. The *Boston Globe* and the *Boston Post* of the same date also contained very conspicuous articles, and gave the movement their most unreserved support. Dr. Hale's own newspaper, *The Boston Commonwealth*, also took the matter up, and these great journals are being followed by the press of New England.

The Boston Conference. On the afternoon, of Wednesday, February 20th, Boston gave the chairman of the National Committee a most representative hearing. The meeting was called for the purpose of listening to the plans of campaign, and of inaugurating a definite movement, provided these plans met with approval. Edward Everett Hale presided. Among those present were Robert Treat Paine, the famous leader and philanthropist; Frank B. Sanborn, the friend of Emerson, Hawthorne, and Thoreau, and one of the most conspicuous figures in the intellectual life of Massachusetts; Edwin Ginn, the prominent publisher, who has become in the late years one of the most conspicuous of Boston's practical philanthropists; Dr. A. A. Miner, another of the best known

and most influential of Massachusetts men; Frederick H. Nazro, Albert White Vorse, James N. North, S. Gannett Wells, Henry F. Miller, Charles F. Birtwell, Everett O. Fisk, Henry Peterson, Miss Sarah C. Paine and Mrs. J. S. Copley Greene. Mr. B. P. Shawhan, of Idaho, was also present to assist in presenting the Western side of the case. Probably it would be impossible to select from all New England a group of persons of similar number who wield a more potent influence. And when it is said that they gave a most hearty endorsement to the plans presented it may be safely predicted that the complete conquest of New England sentiment is soon to be realized. The practical outcome of the conference was the decision to hold a mass meeting early in March, to be addressed by the chairman of the National Committee, and to inaugurate a well-defined movement. The committee named to issue the call for the meeting is as follows: Dr. Hale, chairman; Messrs. Edwin Ginn, Robert Treat Paine, Frank B. Sanborn, Dr. A. A. Miner and A. W. Vorse. It was proposed to follow the Boston meeting with a similar one in New York and Chicago, and ultimately in other prominent cities.

The Lines of Thought Presented. The lines of thought presented at the Boston meeting in behalf of the men of the West may be summarized as follows:

1. The East is burdened with a greater population than can be decently supported under existing industrial systems, and is consequently confronted with a large and increasing element of men who are without remunerative employment during the whole or a portion of the time. This has resulted partly from the growth of labor-saving machinery, which in Massachusetts alone does the work of one hundred million men. The situation is grave and menacing, and demands the most active and thoughtful consideration.

2. In Western America there is room to plant a new nation, as large as the total population of the United States. These people can be sustained upon an industrial system which guarantees high average independence and admits of better social and civic institutions than have ever been known before outside of the best New England towns.

3. The conclusive proof of the capabilities of Western America is found in the economic history of the people of Utah. This was described at length.

4. To meet the criticism that what had been accomplished in Utah was due to the peculiar influence of a church organization, the development of the Greeley Colony of Colorado was carefully traced from the date of the issue of the call in the *New York Tribune*, and the first meeting of intending colonists in Cooper Institute, down to the present day. This was supplemented with the history of the colonies in Southern California.

5. There are two classes in the East from whom recruits may be drawn for the new colonial life of the West. It is necessary to illustrate by practical examples what can be accomplished for the benefit of these classes. And this must be supplemented by the broadest educational work.

6. The first class consists of people who are able to help themselves. For instance, there are young men whose parents can assist in starting a home in the West, and keeping them from getting stranded in the wellnigh hopeless industrial ruts of the East. There are thousands of men of middle age who have toiled for years for other people, and see no prospect except continued toil with discharge in old age, when they are most in need of employment. Many of this class have small savings and investments, not sufficient to support them, but enough to furnish capital to make a good home on an irrigated farm. There are other people who formerly had a fair income from investments, which have suffered a sharp depreciation, depriving them of a living income, and yet leaving sufficient capital for the new life. These are some of the elements in the class of Able to Help Themselves. It is proposed to make a typical colony which will serve as a luminous example of what can be done for industrious people with a capital of $1,000 and upward. This colony is now in process of formation.

7. There is still a larger class of people for whom homes can be made only through the co-operation of capital they do not possess. There is a great abundance of idle capital in New England and the East, and those who own it have a very important stake in the outcome of the present era of unrest. Nothing substantial can be accomplished by charity, since Charity is a free horse and gets very tired after a little exercise. But Legitimate Invesment is a tireless worker, and will move the world's enterprises so long as it is adequately secured and fairly paid. A way must be devised by which the arid public lands can be opened to settlement on terms that will be entirely satisfactory to both the labor and the capital required for the process. This is a difficult problem, but it must be solved, or something will go to smash in this country. And it must be solved by a method capable of indefinite expansion. Many good brains are at work on this problem, which is still in the nebulous stage. The suggestion most favorably considered at the Boston conference was this: Supposing there were five hundred families who could show a record for character, industry and good intentions. Let it be ascertained what it would cost to transport them to one of the new States, to construct canals, to establish modest homes, and to sustain them until they reached a productive stage, the idea being to colonize them permanently on ten thousand acres of land opened by the Carey law. The items of cost in such an enter-



GEO. KINKEL, JR.,
Member of the Board of Directors of the Montana College of Agriculture.

prise will differ very materially with different cases, and it is not pretended that details can be definitely suggested at this time. But merely to illustrate the principle, let it be supposed that the average farm would be forty acres and the average cost of moving the people, building canals, outfitting and sustaining settlers to the productive stage, $500 per family. This would mean an indebtedness of $12.50 per acre. If the cost were $1,000 per family the indebtedness would be $25 per acre. It may be doubted whether the thousands of families who have settled the West up to date have possessed an average of $100 each, but if in this class of settlement the cost were as high as the figures above suggested the security for the investment would be perfectly good, provided the right sort of people were selected for settlers. The security would rest (1) on the canal and water rights, and (2) on the land and improvements. Back of both these substantial elements would stand human industry and the hunger for an independence.

8. As a means of educating the masses to understand the opportunities of Western America the system of Colonial Clubs, suggested in the last number of THE IRRIGATION AGE, and described elsewhere in this issue, was presented to the Boston conference. It was received with enthusiasm, and the first outcome of the movement in New England will be the formation of Colonial Clubs, with a carefully selected plan of literature and, ultimately, courses of lectures. In this way the people will receive fair statements of the conditions in the West, illuminated by the history of the colonists in our Western States. The literature will pass under the supervision of a committee of distinguished Bostonians and will, of course, be entirely devoid of anything in the way of special pleading for localities. It will be literature in the true sense of the word. It is believed that the membership of Colonial Clubs will mount high into the thousands, that it will extend throughout the United States and perhaps through Great Britain, and that the result will be the formation of great numbers of colonies in the next few years. It may be predicted that when the men of the East are convinced that great numbers of people desire to enter upon this colonial life, and that it offers them a chance of independence and good security for the investment required, capital will be found in great abundance. The further development of the plan of campaign will be noted in these pages.

An Idea from Gen. Booth. General Booth of the Salvation Army is dealing with problems which have a close relation to the problems of the national irrigation campaign. In a recent speech at Colorado Springs he used an expression in effect as follows:—"The greatest problem in dealing with the poor is to find a way to give them employment, and enable them to earn their living. I haven't solved that problem yet, but in the course of a railroad journey through England last spring I got an idea. Looking out of the window I saw a large field of wheat, and in a few minutes I came to an adjoining small tract of land, which was walled in and used for a garden. I noticed that everything grew in that garden with great thrift—vegetables, small fruits, orchard fruits, etc. I could see that the family could live, and live well, on the product of that small patch of ground. Then I asked myself, 'Why is this large tract a field of poor wheat, while this other little piece is a garden?' And I answered it to myself, 'The difference is human labor.' When I turn my eyes toward the crowds in your old States, and the old countries across the sea, and then ride through the great unsettled districts in the West it occurs to me that these people ought to be engaged in transforming these idle lands into gardens, which would support them." Yes, General Booth, that is the way out, but where lies the pathway, and how are we to remove the obstacles that encumber it? We have no doubt these questions can be answered by the genius and energy of the American people. They will be answered, and the process of forming public opinion has begun.

Wyoming's Action on Carey Law. The new factor in the situation is the Carey law, which gives each of the States the opportunity to deal with one million acres of public lands without reference to the government at Washington; further than to obtain its consent for the reclamation of particular tracts. It is the Carey law which is furnishing the impulse to the present movement, and the name of the senator from Wyoming seems certain to have a place in the history of his times. Four or five States will utilize the law this year. They all look to Wyoming for an example, since the law comes from that State and is admirably adapted to its conditions. The bill, framed with a view to making the law effective, has been enacted and early developments in the way of actual reclamation and settlement are confidently looked for. If the new law can be carried out in the best public spirit we believe it will strikingly illustate the wisdom of giving the States large powers of administration over the public domain, the nation having first marked out the lines on which development shall be permitted to go forward. One great virtue of the new Wyoming law is that it surrounds the investor and settler with the most ample safeguards in the all-important matter of the water supply. It requires examinations and reports which will demonstrate that the water supply is sufficient, and the canals large enough and of the proper character. This goes to the foundation of success, alike for investment and for settlement. The law is also very strong in the fact that it furnishes security upon the land as well as the water, and this without recourse to the disgraceful methods which have been used in connection with the Desert Land Law. Capital requires such security and ought to have it. But the law is equally strong and satisfactory from the standpoint of the settler. The State fixes the maximum prices of water rights, the land being sold for the nominal sum of fifty cents per acre. The irrigation works go to the people when the water rights are paid for, and will be administered by a district. We see but one dangerous point in the Wyoming law, and this is in the large powers, almost judicial as well as administrative, vested in the State engineer. The Wyoming water laws were constructed on the same plan, and State Engineer Elwood Mead has gloriously vindicated the confidence reposed in him. We have no doubt he will do so again, but the outcome of the law possibly depends too largely upon a single individual, and the occupants of the office in this and other States may not always be of such ability and character as to justify the principle. There are those who predict that the new Wyoming law will be used to defeat, rather than to encourage, the settlement of the lands. It is idle to speculate on this subject. Wait and see. The supreme interest of Wyoming is to obtain men and money for its development. The man or set of men who defeat this ambition and cover the name of irrigation with infamy, will be very daring. We do not believe they can be found, but if such should unfortunately prove true THE IRRIGATION AGE will guarantee to bring them under the white light of publicity.

Chicago Movements. These ideas are permeating all the arteries of public opinion and come to the surface in various places. The "Campaign for National Prosperity," a circular issued by the National Committee, has been in great demand during the last few weeks. It has received wide newspaper comment, and applications have come in for it from all parts of the United States. In the city of Chicago several movements are on foot. One organization is called the Bureau of Labor and Transportation, and has Lyman J. Gage at the head of its advisory board. Its object is to transplant individuals and families to country homes. Another is the Industrial League, started by workingmen and looking to the organization of colonies of idle people to reclaim and occupy public lands. Still another society has been formed by leading clergymen, and it has similar objects. It is difficult to predict the outcome of these various currents, but they all tend in the same direction and it is likely that in the early future they will be brought under one general direction, or at least into a common line of effort.

Fighting for the Forests. The Western people ought to appreciate what the *Century Magazine* is trying to do in the interest of forest preservation. This is not a new interest with the great New York magazine, but one which has enjoyed its earnest championship and to which it is very heartily committed. The February number contains an elaborate symposium, to which Messrs. Edward A. Bowers, of the Land Office of Washington; B. E. Fernow, chief of the Forestry Division of the Department of Agriculture; Frederick Law Olmstead; President J. T. Rothrock, of the Pennsylvania Forest Commission; Superintendent Verplanck Colvin, of the Adirondack Survey; Theodore Roosevelt; Gifford Pinchot, Prof. N. S. Shaler; D. M. Riordan, of Arizona; John Muir, of California; Prof. Cleveland Abbe, of the United States Weather Bureau; Wm. J. Palmer, of Colorado, and Capt. Geo. S. Anderson, in charge of the Yellowstone National Park, are the contributors. The basis of the discussion is the plan of Prof. Sargent, of Harvard, which would provide for forestry instruction at West Point, with an experimental forestry reservation near that place; control of the forest areas by educated officers, and the enlistment of a forest guard, to be specially chosen to carry out the principles of forestry thus taught.

Army or Civilian Control?

All of these authorities unite in favoring a scientific system of forestry. They are unanimous in condemning our present do-nothing policy and in pointing out the very grave dangers to the water supply, as well as the timber supply, arising from the present indifference which exists in most parts of the country, and the purely selfish opposition which is at times manifested in the West. But the authorities by no means agree that the Sargent plan of educating foresters at West Point and putting the forests under the control of the army, is the best basis for a scientific policy. Indeed, the most thoughtful papers take quite decided ground against this plan, favoring the civilian rather than the army officer, and a few favoring State rather than national control. Perhaps a part of this criticism may be explained on grounds of human nature, as several contributors are in the civil service and one or two of them in branches of State governments. Nevertheless they make their arguments rather convincing in favor of the more permanent civilian service. Mr. Bowers is especially effective on this line. Frederick Law Olmstead is inclined "to think that in a satisfactory system of management of our forests men will be needed who shall have given to a study of forestry more time than our military cadets can spare for the purpose without neglect of studies in which proficiency must be required of them." Capt. Anderson thinks his experience in the Yellowstone Park has justified the plan of using the army. The fact is that any system that will effectively preserve the forests against destruction by fire and purely wanton cutting for timber, furnishing a good guard for patrol and providing for cutting trees when they are ripe and substituting them with new plantings, will be satisfactory to the friends of the forests and of the water supply. The question as to whether the army or the civil service can do this work best is of very small importance when we reflect that absolutely nothing is being done now, and that either branch of the service would be able to introduce a great and urgent reform. The present neglect of the forests is shameful, and the results of it are simply alarming. There can be no hope of a change for the better until the country is thoroughly aroused to the importance of the issue. The *Century* symposium is a splendid contribution to this awakening, and in behalf of the Western people THE IRRIGATION AGE thanks the *Century* for all it has done in this direction.

Pecos Valley Railroad Extension.

When the people of Southeastern New Mexico celebrated the completion of the Pecos Valley railroad to Roswell, last midsummer, it was generally supposed that the event marked the end, for the time being, of the vigorous policy of large improvements which have been carried out in the interest of that valley. But it is now announced that the railroad will be extended two hundred miles northeast to Washburn, Texas, where it will form a junction with the Denver, Fort Worth & Gulf and the Santa Fé system. In a very short time the Rock Island will also be extended from Liberal, Kansas, to Washburn, and thus the Pecos Valley railroad will have a direct outlet with three great systems on the north, as it already has an outlet with the Texas Pacific on the south. The completion of the Pecos Valley railroad in the manner proposed is the final consummation of one of the greatest and most comprehensive schemes of improvement ever undertaken in any portion of Arid America. The transformation, in the space of five or six years, of the Pecos Valley from a borderland of cattle and ruffians into a scene of the most active modern life, with its railroads, telephones and telegraphs, with its canals, reservoirs, water powers and electric lighting systems, and with its towns equipped with fine hotels, schools, churches, business blocks and homes—this record of achievement constitutes one of the most stirring pages in the history of the West. The marvel of it is in its completeness and in the brief time in which it has been done. It is due to the faith, nerve and capital of a group of men, headed by J. J. Hagerman, to whom the achievement is but one feature in a most remarkable record of business success. It is pleasant to be able to record that the work which has been done in the Pecos Valley is beginning to bear substantial fruits in the way of settlement. The last few months have witnessed very marked progress in this direction. The Pecos Valley is destined to sustain a very large population and to become the scene of highly diversified industry. It will be an enduring and splendid monument to the men who have made its development possible.

Arizona's New Railroad.

The opening of the new railroad from Prescott to Phœnix, Arizona, marks the dawn of a new day for the Salt River Valley. The northern outlet was very much needed. Competition was also an absent factor and it is not good for any country to have but one railroad; especially if that one is the Southern Pacific. Every person who is familiar with the Salt River Valley has long realized that its day would come, and that it would be a very interesting and hopeful day, too. The valley has a splendid system of canals and many old farming districts, which have amply demonstrated the character of the soil and climate. It would seem that a vigorous colonization policy would quickly succeed in furnishing the valley with a productive population. Probably there is no portion of Arid America which will ultimately sustain more people to the square mile. Singularly enough the development has thus far been in the direction of the large farm unit. The



A SOUTHERN CALIFORNIA ORCHARD ON IRRIGATED LAND.

tendency ought to be just the reverse in the Salt River Valley. A scheme of industry could be devised which would make farming on ten acres extremely profitable in this locality. We hope to see some practical experiment along this line.

Windmill Irrigation. The coming season will undoubtedly see a rapid development in the way of independent windmill plants for the irrigating of small farms, or for small portions of the 160-acre homesteads. With ten acres irrigated, the owner of 160 need never have the fear of starvation before his eyes. He can be absolutely sure of a living for himself and family, if that portion of the property be well cultivated. If, then, the products of the balance of the farm can be practically a clear profit, even though there may be years when little is realized, it will average as well as other branches of business, for few of them are continuously successful. There is, too, the distinctive advantage of owning the irrigating plant, being independent of company exactions and charges. It will serve as a balance-wheel, regulating the larger enterprises by the competition it affords.

Electric Farming. However startling the suggestion, it is quite certain that the substitution of electric energy for human and animal muscle is nearing actual accomplishment very rapidly. All the elements of its practical employment are in existence; it is only the adaptation of the proper generators, motors and conveyors to the work that is to be done. All of these are successful in hundreds of practical applications; there is no good reason why this wondrous force shall not be utilized to drive the plow and cultivator, the thresher and the grinding mill. It appeals with special force to the farmers under irrigation, as in the natural order, the diversion of water sources, and its control in canal and pipes, is almost universally accompanied by the opportunity to employ either its weight or velocity for the creation of motive power.

An Electric Plow. A German invention has mastered one of the most difficult problems, that of conveying the current, or handling the trolley in the open field. A chain is stretched across the field and securely anchored at either end. The anchors are light and easily moved. The chain passes around the shaft of the motor, and the plows are drawn steadily and rapidly from side to side. The cables conveying the electricity are mounted on light rollers, which readily follow the direction and movement of the plow, so that friction and wear are almost wholly avoided. The plows are "double-enders." Two have been built and put in operation. The one cuts two furrows a total width of twenty-four inches, and a depth of nine and one-half inches; the other is a four-plow machine. Both worked equally well. The field was about 200 metres, or 650 feet, across. The power necessary was about eight-horse for the smaller plow, although a twelve-horse portable engine was employed to drive the dynamo. For the larger plow a sixteen-horse-power engine was used. At a speed for the plow of only four miles an hour, its capacity would be about an acre an hour. The cost in the experiment at Halle was found to be less than one-half that of animal power. When the power shall be supplied by falling water in the canals near at hand, the advantage will be still greater in favor of electricity.

Gauging the Streams. The friends of irrigation have made a strong effort to induce Congress to make an adequate appropriation for the gauging of streams in the arid region. The amount originally provided was only $12,500. This sum is ridiculously inadequate to the needs of the country. The effort was directed in favor of amending the proposition to make it $50,000. The lesson that we have learned in dealing with Congress, is that the States must help themselves as far as they possibly can. The time will come when the nation will give us liberal appropriations, but this cannot be until the national aspect of irrigation is thoroughly understood. Perhaps we shall reach this point very soon, but it may take years. Irrigation is the fundamental interest of our arid States. To know the extent and character of the water supply is a consideration of first and last importance. Our States owe it to themselves to expend their own money and effort in this direction, while neglecting no opportunity to induce the nation to perform its duty.

Allied Industries. Everywhere throughout the arid region, it is encouraging to note the growing intimate relation between the stock raiser and the irrigator. Indeed, the stock raiser is becoming the irrigator, and the more prudent ones are providing liberally in the way of winter feed. It is most noticeable in the growing of alfalfa, which is being undertaken everywhere, and, by its use, the stock can be taken through the winter with much less loss and in a condition which gives a great advantage in a better growth the following season. It finds expression the other way. The irrigator is becoming the stock raiser, and although the herd may be small, it may be so choice that the profit from it is proportionately very much greater. The irrigated farm of forty acres can grow quite a little herd of fine stock, and the profits from it will probably be as great as from any staple crop raised for the market.

THE NEW PLYMOUTH.

THE PROJECTED COLONY A TYPE OF THE NEW LIFE OF ARID AMERICA.

By WILLIAM E. SMYTHE.

THE new Plymouth Colony will be made. In fact, it is at this moment in process of formation, and shows the most unmistakable evidences of early success.

This is the colony that has been foreshadowed in the editorial pages of THE IRRIGATION AGE for more than a year, and which was somewhat definitely outlined in the editorial department for December. The new Plymouth is undertaken not as a private enterprise, but as a public work, and as one feature of a propaganda of irrigation ideas. It is drawing to itself the wisdom and experience of prominent men in the West, and is getting the hearty and generous coöperation of distinguished men in the East. Plymouth Colony is intended to serve as a luminous example of what may be done by average people in making industrial and social institutions where they may realize independence and a high degree of prosperity. It has seemed absolutely necessary to make the new Plymouth. True, we have Greeley, the Mormon colonies of Utah, and the successful communities of California, but these were made without much notoriety at the time, and to quote their experience is only a little less effective in moving public opinion than to quote the experience of the ancient Greeks. To provide a living argument for the possibilities of home-making on irrigated lands, it is not only necessary to make the new Plymouth to illustrate the best ideals, but to make it in the presence of the American people *to-day*, and to make it with such dramatic effect that it will appeal powerfully to the popular imagination.

This is the spirit in which I have undertaken this colonial enterprise, and it is in this spirit that some of the best practical men of the West, and some of the noblest friends of humanity in the East, are lending their coöperation. The enterprise is open to the most searching scrutiny in all its phases. A large number of individuals took up the land under Desert entry, and it is from them that it is purchased. No person will have the slightest difficulty in ascertaining precisely the terms on which they sold it. The means required for the preliminary expenses of the work were raised on the personal responsibility of the projectors of the colony, and will be repaid by the colonists themselves, under a plan which is discussed further on in this article. I propose to make my own home in Plymouth Colony, and to take some of my dearest friends with me, which is perhaps the best evidence of good faith that can be furnished.

I.—PLYMOUTH AS A TYPE.

Now, what will Plymouth illustrate, and what results do we hope to accomplish by making it in this conspicuous way?

THE COLONIAL AND ASSOCIATIVE PRINCIPLE.

Plymouth will illustrate anew the strength of the colonial principle. That is to say, it will demonstrate that to form people into colonies or groups is far more attractive and hopeful than to attempt settlement as individuals. The conquest of Arid America is to be accomplished by associated man, rather than by individual effort. Irrigation is associative in its essence. The canal is the bond of union which gives landowners a common interest, and demands for its best results a common effort. The coöperative principle, in its true sense, has no part in the Plymouth plan. Coöperation makes all the members of a community partners in all the affairs of life outside of the family circle. Association means simply that men with a common interest shall work together, obtaining such advantages as come within the reach of their means, but not binding them as partners in any sense. In making public improvements, especially those that deal with natural monopolies, and providing public utilities, such as a libraries, parks and schools, men may associate their efforts, and the power of a united community is simply amazing. But in the field of business, whether of the farm or of the workshop, they do not coöperate, and hence the vital spark of what we know as the coöperative principle is absent. Plymouth aims at progress on associative lines, and I believe it will demonstrate that very great results are within the reach of settlers in a new country when this principle is applied. It is the natural outgrowth of a colonial plan as opposed to the plan of individual settlement, but it has none of the dangers which have rendered the name of coöperation obnoxious to thrifty, successful people.

THE INDUSTRIAL SYSTEM.

The second great object of the new Plymouth will be to demonstrate that there is an industrial system in Arid America which enables every family to obtain a generous living, regardless of panics, drouths, and political misfortunes, and guarantees this living for an indefinite period.

The time has been when every man who went West was moved by a spirit of speculation. This was true not only of those who rushed to new towns, but equally true of farmers. They have gambled in wheat, corn and cotton, in oranges, prunes and raisins. In their mad haste to get rich they have neglected to get a living. The only philosophical basis for the economy of farm life is that each family should own its home, and that upon that home it should realize, first of all, industrial independence by systematically producing the things it consumes. While everybody at Plymouth will be at liberty to plan his own farm as he chooses, the aim of its projectors is to show how small farms can be organized with a view, first, to the production of what the family consumes, and, second, to the production of a wisely chosen surplus, the sale of which will realize an income available for the improvement of the home, the education of the children, and provision for old age. These two ideas are the basis of the Plymouth industrial system, and they lead, as inevitably as the waning night unto the morning, to human independence in its best, its truest, and its sweetest sense. Religious independence and political independence are well, but industrial independence—that is to say, independence in the ability to protect and sustain the loved ones at our fireside—is the vital thing. Upon the basis of the Plymouth industrial system millions of men may realize this most sacred form of human independence.

The associative principle affords still further possibilities in the direction of organizing industry. Two hundred families, possessing a fair degree of means

and united in an earnest effort to make their little valley the best place on earth, can do many things to enhance their prosperity. They may unite their common capital and provide industrial plants, such as creameries and canneries, to furnish the most profit-



Natural Growth of Sage Brush in Payette Valley.

able kind of market for their surplus products. This may or may not be done at Plymouth, as the colonists shall themselves determine. But if it be done, it is not my idea that these plants shall be handled coöperatively in any sense, but merely that the colony shall invest in the plants, and then lease or sell them to parties having the necessary experience and capital to operate them. The colony would thus attempt only to make sure that it was provided with allied industries essential to its highest prosperity. The income from leasing the plants would be available for public purposes. So also in the matter of keeping up the standard of the colony's products. The measure of individual prosperity will be the standard and reputation of the products of the community. Plymouth will be well advertised, and I predict that Plymouth butter, Plymouth prunes and Plymouth canned goods will command the top of the market, as do Greeley potatoes and Riverside oranges, provided the standard be held to the highest notch. Men who are acting together in some degree of association can realize benefits from this principle that are utterly beyond the reach of individuals who have gone into a country in a scattering way, having no mutual interests or aims, and hence no *esprit de corps*.

So also in the matter of curing, packing and marketing fruit. I think the commission man need not apply at Plymouth. I think my friends and neighbors will prefer to get together and send their own representatives to the Eastern markets to sell the prunes, pears and apples of the famous Plymouth. So there are many other benefits to be realized from the associative principle on the side of industry.

THE SOCIAL SYSTEM OF PLYMOUTH.

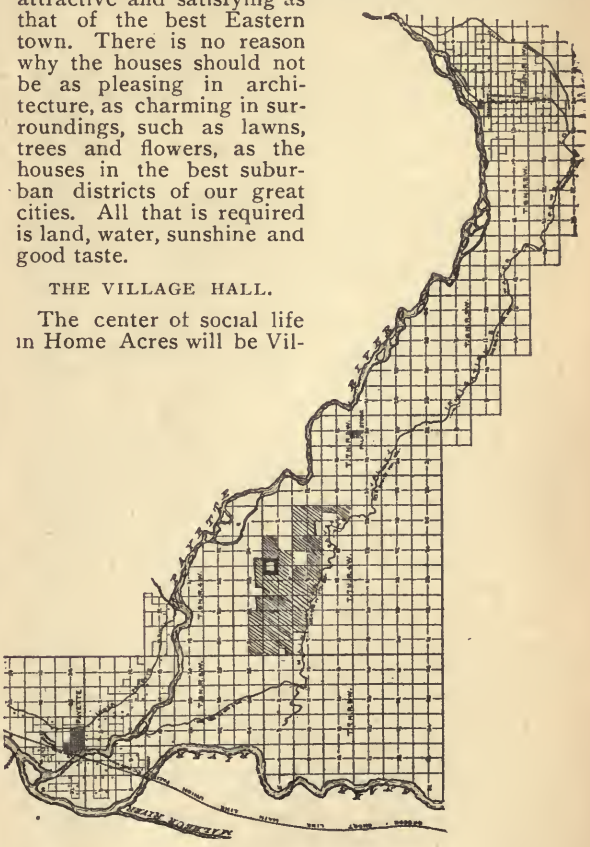
Another most important principle in the making of colonial life in Western America will be illustrated by the social system. Isolation has been the bane of country life. The hunger for human companionship has depopulated the farms and crowded the cities with a congested and well-nigh hopeless population. Irrigation means intensive cultivation. It means a small farm unit. It leads us by a natural process to neighborhood association. It remains with us to utilize the opportunity and make the best of its hopeful possibilities.

There are two instincts common to all mankind to a greater or less degree. One is the passion to own land—the agrarian instinct. The other is the social instinct—the hunger for human companionship. These two instincts have seemed irreconcilable, but this is another problem which Arid America will solve. Plymouth, on the side of its social system, strikes its first blow at the bareness and loneliness of country life, and seeks to blend the charms of the country with the advantages of the town.

The farm village is not a new institution. It is old in Europe. It was adopted by some of the Massachusetts towns two hundred years ago. It served as the germ of the Mormon social life. In the midst of Plymouth Farms will stand the village of Home Acres. Each colonist when he purchases his farm will also receive one acre in the village, provided he will agree to build his house there. From the park in the center to the outside farm will be less than three miles, while the farms will average much nearer to the village. The farmer must ride out to his land, but his wife and children will live in the midst of neighbors, close to the school, church, post-office, store and other town institutions. There is no reason why the social life of Plymouth should not be just as attractive and satisfying as that of the best Eastern town. There is no reason why the houses should not be as pleasing in architecture, as charming in surroundings, such as lawns, trees and flowers, as the houses in the best suburban districts of our great cities. All that is required is land, water, sunshine and good taste.

THE VILLAGE HALL.

The center of social life in Home Acres will be Village Hall, which will take the form of a reproduction of the picturesque Idaho State Building at the World's Fair. It will be constructed of stone and rough-hewn logs, exceedingly attractive and unique. The lower floor will be devoted to public offices and



Map of Payette Valley, Idaho.
Shaded portion showing Plymouth Colony and Home Acres.

a public hall. The upper floor will be used as a public library, and it is my earnest suggestion that this shall be named Hale Library, in honor of Edward Everett Hale, Boston's great author and divine, to whom I am indebted for a most kindly reception of

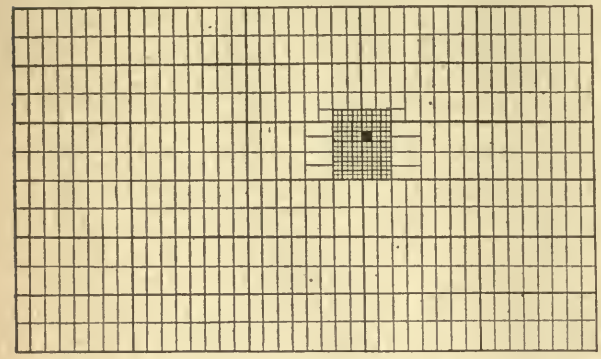


Diagram of the Village of "Home Acres]" and surrounding "Plymouth Farms."

the Plymouth idea, as well as of the larger plans for the irrigation propaganda. When I explained Plymouth to Dr. Hale he called in his good wife to testify that she had been compelled to resist his impulse to emigrate once in each six months for forty years. His great heart, at least, will be with us in the new Plymouth.

Home Acres should have good side-walks and streets. It is with a good deal of timidity that I break the news that we propose to have the farm houses of Plymouth Colony lighted by electricity, provided colonists will "lend a hand," to quote the famous phrase of Dr. Hale. Power can be provided by building a short but wide canal, and the colonists can do it by their common labor during a few weeks in the autumn, when they have little else to do. We assume that the plant would cost, complete, not more than $10,000, and that an annual charge of $10 per family would supply houses with all the light they could use, as well as power for domestic purposes, such as running sewing machines. It would also furnish light for streets, stores, public buildings, etc. Electricity is to play a most important part in the evolution of our new colonial life. Later colonies will doubtless surpass Plymouth in this regard, but we must have electric light in the houses. I hate coal oil!

On such a social system as that of Plymouth there is simply no reason why farmers and their families should not enjoy all the good things of town life, with a minimum of its drawbacks. Think of winter in the new Plymouth! The barns and store-houses bursting with the products of prosperous husbandry; ample feed for the fowls and animals of the barn yard; the best of literature and current newspapers and periodicals available at the library, with lectures and entertainments in the Village Hall; and best of all, the long evenings with our dear ones at our own sovereign firesides!

There is not a feature of the industrial and social systems outlined which has not been tried and vindicated by experience somewhere. Plymouth is only new in bringing into association in one colony the best features of various experiences, and in attempting to bring within the reach of plain, average people the advantages of our modern civilization. There may be those who doubt the wisdom of trying to realize so high an ideal. *But the thing must be done*, because civilization pleads for progress—because humanity cries aloud for more room in which to build its habitations. Plymouth is a necessity. And it is with the utmost gratification that I inform the friends of the West that it is on the highroad to success. Among the many people who have applied for membership not one has talked about profits per acre, but all have responded heartily to the idea of individual independence and the highest order of social conditions. Men are hungry for these things, and Arid America is bursting with raw material of the food which can satisfy their appetite for something better.

II.—THE CHOSEN VALLEY.

Mary Halleck Foote, the distinguished novelist, who, by the way, is a resident of Southern Idaho, recently published a charming story, entitled "The Chosen Valley." The expression applies very hap-



A Branch of Prunes.
From a Photograph taken in an Orchard in Payette Valley, Idaho.

pily to the Plymouth Colony undertaking, since the Payette Valley has been chosen, like the one in which the scene of her story was laid, with the most careful thought of the prosperity and happiness of settlers.

LOCATION OF THE VALLEY.

The Payette Valley is located in the extreme southwestern portion of Idaho, close to the boundary of Oregon. It is about 400 miles from the Pacific Ocean. It is sixty miles from the capital at Boise, and many important mining camps are located within a short



First Year's Crop on Irrigated Land in a Payette Hop Yard.

distance in the surrounding mountains. The Payette River flows through one of those narrow and picturesque valleys which serve to develop the most pleasing aspects of rural life in the arid region. The valley is about thirty miles long and four miles wide at the place chosen for the colony.

About 5,000 acres of land have been selected and contracted for from various individuals, at the rate of $20 per acre, with an additional charge of $3 per acre for that part of the land cleared of sage brush and ready for immediate cultivation. This price includes a perpetual water right for irrigating the land.

The soil of the Payette Valley is very deep and rich, and adapted to perfect drainage. It contains the aggregated and condensed richness of the vast areas of vegetable growth that have been accumulating for ages on the mountain sides. An analysis shows it to be pre-eminently rich in all the mineral and vegetable elements, and therefore favorable to the growth of cereals, vegetables, fruits and everything else which it is desirable to include in a scheme of diversified farming. The natural growth is sage brush, which is recognized as the certain evidence of rich soil. In the Payette Valley the sage brush growth attains extraordinary proportions, and the fertility which this fact foretold to early observers has been fully realized by actual experience.

HOW THE VALLEY IS WATERED.

The Payette River is a perennial stream of noble proportions. It is fed by the melting snows of the Sawtooth mountains, and has a very large drainage area. The average flow of the stream is over 3,000 cubic feet per second, or sufficient to irrigate 150,000 acres of land, while not more than 60,000 acres can ever call upon it for water. This is a matter of the most vital importance to the settler. He knows that there can never be a question about his water supply. A substantial canal has been built at a cost of about $400,000 to cover the best lands. This canal is some forty miles long, having an average width of twenty-five feet, and an average depth of five and a half feet.

PRODUCTS OF THE VALLEY.

When it is said that the Payette Valley is in the milder portion of the temperate zone, with an altitude of 2,300 feet above the sea level; that the soil is rich, deep and kindly; that the water supply is unfailing, and that there is entire freedom from hailstorms and destructive winds, it does not need to be added that all the vegetables, cereals, grasses, small fruits and orchard fruits, together with all the meat products and those of the dairy, can be successfully grown. The valley, is famous, however, for its prunes, pears and apples.

PROFITS OF THE FARM AND ORCHARD.

Under the industrial system which it is proposed to adopt at Plymouth, each colonist will first aim to obtain a prosperous living from the soil. It is impossible to estimate the average profit per acre upon the surplus product beyond the living. This profit will vary much with the skill and enterprise of individuals. It will vary also with the class of crops produced. It will vary still again with the use to which this crop is put. For instance, the Payette Valley produces from four to nine tons of alfalfa per acre, and six tons is a fair average. It sells in the stack at all the way from $5 to $12 per ton. Taking the lower price and the average yield as the basis of an estimate, it is seen that alfalfa raised for sale in the stack would bring $30 per acre. But one farmer who put ten acres into alfalfa and fed it to hogs last season, fattening them on grain for which he paid $250, realized $960 for his hogs. Deducting the price paid for the grain leaves a net price of about $700, or $70 per acre for alfalfa raised for the purpose of feeding to hogs. David Gorrie, of Payette, sold his prunes for 1½ cents per pound, and they netted him $250 per acre. Apples sell for 3 cents per pound, and six-year-old trees average 200 pounds each, earning $300 per acre. While it is likely that the largest ultimate profits will come from the orchards, it is equally certain that the first profits will come from tomatoes, sweet corn, peas, beans, cucumbers and other vegetables, which will be disposed of at the colony's cannery.

A MARKET AT HOME.

It fortunately happens to-day that each of the arid States is importing very large quantities of things it ought to produce at home. This is so because mining, the range stock industry, and the growth of railroad towns have kept in advance of diversified agriculture. Thus it will be very easy to select a number of surplus crops which can be disposed of profitably in the large and growing home markets. It will be many years before colonies organized on the Plymouth plan ship very largely to distant markets, although certain crops of very superior quality will naturally seek markets, near or far, which can afford to pay the highest prices.

THE COST OF STARTING.

The amount of money required to start a home in Plymouth Colony is also largely dependent upon the in-

dividual. Some men have started with almost nothing in Idaho, and accumulated a competence of $10,000 in a few years. Some have started with considerable capital and have not fared half as well. But as Plymouth Colony is designed to serve an important purpose as a type, it is eminently desirable that colonists



An Irrigated Rose Bush.

should have sufficient capital to make a good showing in the matter of their homes, improvements and surroundings. One of the best settlers, and one of the most prosperous in the Payette valley to-day, started with $350, and says he would not have known what to do with more than $500. Nevertheless, the projectors of Plymouth Colony hope the new Pilgrim Fathers will possess one thousand dollars each as a rule, and if they have more, the character of homes and surroundings in the farm village of "Home Acres" will be just that much more attractive and satisfying. Here is what can be done with $1,000:

20 acres at $20, $400, first payment	$100
20 shares stock, $20 first payment	100
Fencing	50
House	350
Stable	25
Horse, Cow, Wagons, Plows, etc	250
Alfalfa seed for four acres	10
Trees for sixteen acres	115
	$1,000

EMPLOYMENT FOR COLONISTS.

There will be a large amount of employment for colonists who may desire to avail themselves of the opportunity. They will be given preference over outside workmen in making all the improvements upon the land, and in the mechanical trades employed in the erection of buildings, industrial plants, etc. There is also much demand for extra help when the hops and fruit are being harvested upon the older places in the valley. There is a demand for 500 hands in hop-picking alone for thirty days in each harvest season. This gives employment not only to adults, but to children who wish to work.

Idaho is well timbered and the Payette valley is particularly favored in the matter of a cheap and abundant lumber supply. There are millions of feet of the best pine and fir timber on the Payette river, which is floated down the stream to Payette and there manufactured into lumber. Rough lumber sells for $10, and from $12.50 to $25 for planed and finishing per 1,000 feet.

On the Payette river, forty miles above Plymouth, are good fields of bituminous coal. It is used now by the people in the immediate neighborhood. A railroad is certain to be built from the mines to the line of the Union Pacific at Payette, passing directly through Home Acres and Plymouth Farms.

Payette, Idaho, which adjoins the Plymouth Colony lands, is an attractive little town on the Oregon Shortline railroad, forty miles from its junction with the Oregon Railway & Navigation Company. Payette has a first-class school, four churches, good hotel, bank, large stores, two sawmills, and other industries. It contains many fine dwellings, and is surrounded by beautiful drives. Orchards and gardens are in an advanced stage of development, as water has been supplied for irrigation for several years.

One of the pleasantest features in connection with the location of Plymouth is the easy access to resorts in the mountains.

The eminent authority, Prof. L. H. Bailey, the horticulturist of Cornell University, in *Annals o Horticulture* for 1893, pays the following high tribute to Idaho's horticultural product: "Second to the display of citrus fruits from California, the Pacific Northwest arrested the attention of visitors. Idaho, Oregon and Washington held a prominent place from the first, although Oregon exceeded the other two in the amount of fresh fruit exhibited. The fruits of this entire region are remarkable for their enormous size and high color, and particularly for the strange influence of climate which they show.

The display of apples from the Northwestern States—Idaho, Oregon and Washington—were characterized by fruits of enormous size, high color and remarkable freedom from scab. To the Eastern man the most interesting variety from these States was the Yellow Newton Pippin, which is the leading apple over a great territory there, and which is twice as large as the same apple grown in the Hudson River Valley.

III.—THE BUSINESS PLAN.

The Plymouth Colony lands will be sold, including perpetual water rights, for $20 per acre. But this is not the entire cost involved in securing the benefits



Four-Year-Old Apple Trees.

of the colony. The expense of the preliminary work in organizing the colony must be repaid to the projectors, who have raised and advanced it. There must be a fund for improvements, such as

country roads and village streets, the erection of the public hall, and the provision of other facilities essential to the comfort and prosperity of the people. It is these improvements and facilities which will



View of Payette River.

render Plymouth unique, and make it serve the purpose of a type of the best industrial and social institutions in Western America.

The land and water rights being sold to the colonists at actual cost, it is proposed to incorporate the Plymouth Company, in which each colonist must purchase one share of stock for each acre of land. While many of the details have been purposely left open to be settled by the colonists themselves, it is probable that the price of the stock will be $10 per share. Of the tract of five thousand acres, 480 acres will be reserved for the village site, which leaves 4,520 to be sold at $20. At $10 per share the stock would realize $45,200. The total investment for each colonist will be $30 per acre. This covers the cost of his farm, of his acre lot in the village, and his share in all the improvements and industries. Readers of THE IRRIGATION AGE need not be told that this price is very low for raw land alone, if of the best quality, and if supplied with a reliable water right. The plan of payments is as follows:

Cash, $5 per acre on 20 acres	$100
Cash, $5 per acre on stock	100
End of first year, $5 per acre on stock	100
End of second year, $5 per acre on land	100
End of third year, $5 per acre on land	100
End of fourth year, $5 per acre on land	100
	$600

One of the most interesting and valuable features of the new Plymouth will be the illustration which it furnishes of what can be done by a party of people, possessing small means, who associate themselves together to create a symmetrical community. By adding $10 per acre to their investment, which still permits them to get the land at a very low price, they obtain the home acre and make sure of the advantages of neighborhood association. They get the benefit of good streets with shade trees, of a commodious town hall set in the midst of a beautiful park, of a public library, electric light plant and the other features of modern civilization. But this is not all.

ALLIED INDUSTRIES.

The presence of certain industrial plants is essential to the highest prosperity of the Plymouth colonists, in order that their products may have a home market, and be manufactured into the most profitable and salable form, thus supplying a part of the demand which is now satisfied chiefly by importations from other States. It is estimated that a creamery can be erected and equipped for $4,500; a canning factory for $4,500; a starch factory, $5,000; an electric light and power plant, $10,000; a hotel, $5,000. Besides the $45,200 realized from the sale of stock, a considerable sum will be realized from the sale of business property and residence sites to the population which comes in to conduct stores and industries. There will thus be ample funds for all these improvements. It is not designed that the community shall operate the industrial plants, but that they shall lease them, or, better still, sell them on easy payments. This would give the colony a revolving fund of about $50,000, which could be used for the creation of industries as the need arises. Village Hall and the electrical plant will probably remain as permanent investments. There can be no question about the prosperity of a community which takes for its foundation the agricultural scheme of Plymouth, with its systematic production of what the people consume, and its wisely chosen surplus crop, with its allied industries and its charming social possibilities.

The Plymouth Colony lands are eight and a half miles distant from the Oregon Short Line Railroad, but arrangements are already under way for a railroad to cover this short distance, and it is hoped to have its construction begun by the time the main body of the colonists reach Plymouth next August. The new Plymouth will then be dedicated with impressive ceremonies, as a type of twentieth century civilization in Western America.

□I put Plymouth Colony boldly forward as a legitimate and most important feature of the propaganda of irrigation ideas. I believe it will benefit every com-



Prune Trees Four Years from Planting in an Irrigated Orchard.

munity and every State which desires to obtain good settlers. I believe the making of this colony in accordance with high ideals should prove to be a real and lasting service to the country and to the race. □

COLONIAL CLUBS FOR ARID AMERICA.

THE system of Colonial Clubs, briefly outlined in the February issue of THE IRRIGATION AGE, will be launched from Boston early in March, and from Chicago during the same month. It is hoped that these clubs will rapidly extend throughout Eastern States. If they prove popular in one place, they will in another, and it may be predicted that their membership will rapidly mount high into the thousands.

The Colonial Clubs will doubtless be composed of all sorts and conditions of people. The idea should appeal to everybody who is willing to consider a chance for bettering his condition by entering into the new life of the Greater West. There are many indications to lead us to believe that this class of people includes millions of American citizens. It embraces not only working men who have been crowded down and, to a considerable extent, crowded out, under the crushing weight of modern industrial conditions, with its constant growth of labor-saving machinery; but it embraces also the small merchants, who are being swallowed by the department stores in great cities; the myriads of young men who are liable to be swept into the ranks of helpless classes; the many who, having toiled for years as employés, and having accumulated some little means by economy, yet see no future except continued toil without adequate provision for old age; it includes, also, especially in New England, many who have formerly had a living income from investments, but whose investments have depreciated until they can no longer support them, though enough is left to furnish capital for a start in the colonial life of the West.

The Colonial Clubs will work along the lines of the Chatauqua system, aiming to educate the people through a comprehensive scheme of literature, and, ultimately, of lectures. Members will pay the bare cost of providing the books and phamphlets. The initial feature will be the campaign circular issued by the Chairman of the National Committee. This will be followed by a condensation of Senator David Boyd's History of the Union Colony of Colorado. Then there will be pamphlets on various aspects of the industrial and social life of Utah, on the colonies of Southern California, and other localities of the arid region. The climate of Arid America, together with impartial descriptions of the different States and Territories, with their boundless resources, will be fully set forth. A score of the best writers of the arid region will be invited to coöperate with the Boston Committee and the National Irrigation Committee in the prepartion of this literature. Probably the same literature will be adopted everywhere, and one board of editors will suffice. This board will be sufficiently eminent to furnish an absolutee guarantee as to the character of the statements put forth.

Next fall the Fourth National Irrigation Congress may be asked to furnish a dozen lecturers from the various States to meet the members of Colonial Clubs at central points.

The Colonial Club system can only work upon broad lines. It aims at popular education upon a subject of which the American people are to-day in denser darkness than about the interior of Africa. It aims to unfold to their vision the empire where national destiny is to be wrought out in the new century. Such a work as this must be above all suspicion of personal or local interest. It must be organized and carried out as a matter of the highest public spirit. The Chairman of the National Committee invites correspondence and coöperation in this spirit.

The practical result of this educational work will be the spontaneous formation, in time, of hundreds of colonies for Arid America. They will be guided in their location by the differing tastes and financial means of different groups. Doubtless many of them will choose private lands, because their owners can offer superior inducements in the way of assisting to create attractive and prosperous communities; but probably the majority of people will flow upon the public lands, and the Carey law will be speedily put to the test. Readers of THE IRRIGATION AGE will be kept informed as to the progress of the movement for Colonial Clubs.



THE SAN FRANCISCO MOUNTAINS IN ARIZONA.

IRRIGATION PRINCIPLES.*

V. CONTROL—ENTERPRISE.

AUTOCRACY AND SOCIALISM IN IRRIGATION.

BY WM. HAM. HALL, MEM. AM. SOC. C. E.

THE word autocrat is not here used in the slightest degree offensively. The absolute control, in practice, though in theory and in law there may be checks and limitations provided, of that which is a necessity of life to a population, by one or several associated persons owning the means of supply, and the distribution of that necessary article under rules with the establishment of which the people served have no voice, by agents in the naming of whom the served have no choice, and in a manner primarily to suit the interest and for the profit of the owners of supply works, is surely an autocratic function. It may be exercised in a kindly, liberal spirit. But that does not alter the case or principle. The liberality may be present one year and gone the next, as owners or managers change.

The fact is that the irrigation cultivator's crop is largely at the mercy of the canal management. In ways that are difficult to appreciate except by experience, any one or a set of irrigators under one work may be much damaged by tricky management; or incompetency or neglect on the part of the management may well near ruin a whole community, and still there would be no practicable redress. The case is different in essential particulars from those of water and gas supplying in a city. In these latter the commodity is constantly on tap in the consumer's premises. He takes what he wants and pays for what he uses. This can never be the case in irrigation water distribution but in the rarest instances, not here to be considered. Almost without exception the irrigation cultivator receives water only when willed by the canal management, under some system more or less liberal in itself, and subject to liberal or illiberal, efficient or inefficient, administration.

The management of water delivery and distribution to irrigating customers by private corporations or canal owners in this way is essentially and necessarily autocratic. There are two interests which almost invariably think themselves in antagonism, and often are so—the supplyer and the applyer of water. The practice is one which unavoidably gives rise to many conflicts, and can be made by either party to keep the other in constant turmoil. In recounting the early history of irrigation in Italy, it has been written, "There are no other occupations which seem to develop the baser traits of human nature to a single end, quite so much as those which depend on the use of water furnished for rental by some one else, except the occupation of furnishing it."

Everywhere in older countries irrigation development and practice have brought their conflicts, and in every instance except where the strong arm of government establishment has extended over a subservient and non-progressive people, autocratic ruling has, in course of time, given way to, or been forced to compromise with, the socialistic principle in community control. The result seems to be inevitable. If there is anything in the teaching of history this rule should be accepted: Uncontrolled speculative irrigation water management does not long exist; the users of water in irrigation will in the end control distribution to themselves. Remember, we are looking at the subject broadly, and not only for to-day, as it were.

Nor is it strange that this result should always come about, when we consider that the very nature of the practice sometimes brings hardship to the water users, which they always attribute to fault on the part of the supplying company. It matters not how diligent, fair and accommodating an irrigation canal administration may be, the farmer whose crop suffers, or who is inconvenienced by not getting water as he needs it, though the supplying him to meet his necessities or suit his whims were a matter of impossibility, still holds the company management responsible in his thought. These feelings, cumulating throughout the population, can lead to but one result—the taking and management of the works, under some arrangement, by the people served, and this is always done under some form of community or district organization.

THE LOGIC OF CONTROL.

The recognition of this uncontrollable tendency has long ago resulted, in all European irrigation countries, in the rule that in granting irrigation water rights and canal concessions to companies, the irrigators or land owners under each, must first be organized into a community, then be made a party to the concession, be given certain privileges toward controlling sub-distribution, and at the end of the period of concession, generally twenty to fifty years, the works and all rights are to go to the community as its property.

Then, too, where the autocracy of the water or canal company and the socialism of the irrigation community are thus brought into relations, the government administration forms a mediating and controlling third party to the arrangement. The company, virtually, becomes a contractor, to build, maintain and operate certain works for a stipulated period of time, in consideration of certain water rates being paid by the community, and the government sees that each party carries out its part of the contract.

The necessity for the controlling third party is here based, be it observed, not on solicitude for the community interest alone. The contracting company or syndicate has been given a concession, on the basis of which it invests its money to get what is considered a fair return. The government, though it may assume no financial responsibility whatever, protects the company by undertaking and reserving the right in the articles of concession, to force the community to comply with its part of the contract.

Herein we find the spirit of control carried to its utmost extent. What has been the reason for it? Simply that even where bound together on the basis of government concession and by a contract which has been fully considered in every detail, the two discordant elements of irrigation development—the autocratic management and the socialistic irrigator—will fly asunder, and combative human nature will still seek to avoid paying debts when it fancies itself aggrieved or can conjure up some self-satisfying reason for the action.

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What should we learn from this? First, that all irrigation enterprise should be so organized as to result in ownership and control of individual works by those served under them, either from the commencement of operations or at the end of a term of years fixed in the articles of agreement; and, second, that to insure amicable continuance of relations between managers of irrigation enterprises and the irrigators under them, during the period of development, the services of a third and superior party is required as an authoritative referee. This party can be no other than the State.

In the interests of the party primarily concerned, why is this? Suppose the irrigation companies and the irrigators do not want State or any other control? Yet, why should they have it in their own interest? Wherein would they be mistaken in opposing it? ANSWER.—In this: Under whatever form of enterprise irrigation may be developed there are other parties at interest besides the promoter or manager or owner of the scheme and works, and the irrigators or land owners under it. The public at large is always a party at interest, and capital is almost always so, in a direct way, and always at stake, indirectly.

Almost every irrigation enterprise except those where the works are constructed by communities of irrigators, on a cash basis—their labor usually being their capital—requires much money to carry it out. It is raised on bonds, stock and shares, lands or water privileges of the enterprise, directly; or, indirectly, on the lands to be served with water, either by the owners or by the company having water supply contracts with the owners and liens on the lands as security.

In some such way it must be had from the world's capital. To get it on advantageous terms the investor must be protected. There has been sufficient experience in other countries, and our own is now furnishing a crop of examples, to warn those who control investment moneys, that the construction alone of irrigation works does not result in successful enterprise, but that there must be general success in irrigation under those works in order that the enterprise may meet its financial obligations.

In this the way the interest of the irrigation companies and of the irrigators in every case depend on protection to the public and to capital in all cases, and this protection can only be accorded by the establishment of State control over irrigation enterprise.

THE ECONOMIC PROBLEM.

There are a lot of parts which are necessary to success in irrigation enterprise: (1) An adequate water suppy; (2) suitable lands to put it on; (3) efficient and lasting works for delivery and distribution, constructed within economic limits of cost; (4) fair and efficient management of those works in the interest of irrigation under them; (5) and a contented, industrious and skillful population of irrigators located on the land.

The prerequisites of market for produce, and of transportation advantage, as affecting the business interests of irrigation venture, are not here to be considered. For the moment we take it for granted that these are favorable, yet we must have the above numbered parts of the economic problem in order that we succeed. And such success there must be, else capital will not be safe. The money has gone into the works and other things unproductive except through the medium of the irrigator. The capitalist does not want the works; he doesn't want the lands. He wants the interest on his money, regularly paid, and his principal returned when it becomes due. He cannot operate the works to make money out of them except he has irrigators, and he cannot sell the land for his advantage except to irrigators; and people desirous of becoming irrigators will not buy lands operated apparently for the benefit of capital. This is a group of great general truths, made such by experience in other countries; and, as I have said, our own country is contributing testimony in the same line.

When American irrigation securities have been offered in European markets, they have not, as a rule, found sale through the older established channels of financial dealings or to the more experienced handlers of investment moneys in the financial centers. Why has this been? Because it is known to many of those who control investment moneys that the construction of irrigation works is not a paying end, but merely a means to an end; one of five parts in a great economic problem; that the safety of the investment depends on the felicitous accomplishment of *the end*—the working out of the entire problem, that the management of the works cannot, as a usual thing, operate them profitably without the coöperation of a population of irrigators settled under them.

When we thoroughly appreciate this fact and all that it means we have made a long step toward understanding why there has been so much disappointment in irrigation development enterprise, and why irrigation securities have been so slow of sale.

THE FUNCTION OF SPECULATIVE ENTERPRISE.

When we have thus followed through a line of reasoning and come to a conclusion as to "what ought to be" in irrigation we have only looked at one side of the living question, and have yet to consider how far this conclusion must be modified by "what can be" under existing circumstances.

In the first place, irrigation cannot be liberally or generally developed in this country under any one form of enterprise. Conditions make necessary variety in organization and promotion to meet the varied cases.

It is useless, for instance, to talk of association of district construction of works for the reclamation of desert lands. There can be no local association without a resident people, and settlers cannot exist on our far-reaching, unwatered deserts long enough to form communities and carry out works of irrigation, except in cases of peculiarly favorable and small schemes, such as were open in Utah and elsewhere when Mormon community effort in irrigation commenced. That time is now gone by and that class of opportunity nearly exhausted.

In advance of irrigation there is little or no value in desert lands. In advance of broad and expensive investigation there is no knowing just where conditions are favorable for great enterprise—what area and water supply should or can within economic limits be brought together. Mere settlers can neither make these investigations for themselves nor take advantage of the results after they are made by the government. Hence, without a settled population, without established land value, without a clean-cut enterprise to work to--without the advantages to be commanded only by capital and business organization—there is no basis of credit. And, hence,

legitimate enterprise for irrigation development of great desert areas, on the basis of district organization and credit alone, is impracticable.

Moreover, the conditions which govern this result are present in modified form and lesser degree, only, in a very large proportion of the cases which our country presents for irrigation enterprise, even where the lands are not strictly "desert" in character. Thus, the point at which it might be said there is sufficient population and enough established value to serve as a basis for legitimate district effort is not found at the limit of purely desert conditions. There may be well established but sparse settlement of an area, and some value to the lands for wheat-growing or grazing purposes, and still neither a population nor a land value sufficient to form a basis for the scheme necessary for the irrigation.

In such cases, as well as those of wholly unoccupied desert lands, in order to get the people, as well as such money as can be hired for interest only on the basis of established values, a large proportionate amount of capital must first be invested—to create the margin on which mere hired or employed capital may be had. This means, unavoidably, the precedence of speculation for profit, as distinct from mere investment for interest. In the one case, the capital manages the initial enterprise to make profit out of the result of development; in the other case money is simply employed on bonds as security, but is managed by the community. The broad fact is that the conditions under which pioneer irrigation has to be developed are generally such as do not attract mere investment capital.

The inference is plain. While it is indeed desirable for all irrigation enterprise to be so organized that the control of works and water supply will untimately come to the irrigators, it is generally necessary that capital be interested in the development on a speculative basis, primarily, up to that point where the lands are settled and values established. In other words, the element of speculation generally, cannot be ignored in irrigation development, unless the government, Federal or State, advances its credit and its paternal management to bring the lands under irrigation command in advance of settlement.

Enterprise—speculative enterprise—must be connected with the great majority of irrigation schemes in order that they succeed. The construction of great works for the conservation and delivery of waters to make fruitful vast areas of land on which people cannot, except at a great disadvantage, live without irrigation is surely a legitimate and worthy field for the employment of capital. If money and business organization and management which go with it cannot find profit and welcome in such employment, to what class of enterprise may it with confidence turn? Given: Conditions under which the individual man cannot possibly construct the means to make his living out of lands, and an aggregation of men cannot exist and carry out works without considerable money on which to live and provide materials for works which if constructed would not profit them until the lapse of time and the incoming of many more people, but in which, after such time, the initial profit in enchanced values would be great, if business management has been good. Surely these are conditions under which speculative capital and organization should be admitted, welcomed and protected in legitimate gain.

If such capital has already gone into irrigation enterprise in a way to oppress settlers, monopolize lands and waters, or otherwise to the public detriment, it is the fault of laws which have permitted such abuses. Such laws should be amended and legislation provided under which legitimate speculative enterprise in the field of irrigation development may prosper to the good of the settlers and the country at large.

A PRIMARY CONCLUSION.

Recalling now the five great parts necessary to be brought together for the success of irrigation—putting them briefly, water, land, works, management, irrigators—their successful uniting is not to be accomplished in our country by either general government or State action alone in any case. That both Federal and State action is necessary should be conspicuously apparent from what has been herein written; but beyond the legitimate and necessary steps to control and promote enterprise for social and economic reasons, and to conserve the public water supply, neither State nor Federal authority should go. This special point is worthy of a separate paper for it has a history.

Neither are the five great parts of irrigation existence to be successfully brought together by community action alone. In some cases there are agricultural neighborhoods already well settled upon the basis of dry farming or a crude system of irrigation, and where it is desirable to introduce a better system. Here are two of the parts already united—the lands and the people—sufficient for a fair measure of success in irrigation itself, and the elements of value on which to hire invesment capital ought, consequently, to be present, so as to leave outside speculative enterprise out of consideration. But control, on the part of the State, cannot be dispensed with, for, though some enterprises of the kind may fully and economically succeed without control, a system based on association without control is so far open to abuse that it will inevitably be wrecked and the good applications will suffer with the bad.

Neither can we expect that land, water, management and irrigators can or will be brought together, as they ought to be in hundreds of cases scattered all over our country, by the intervention of speculative enterprise alone. I do not qualify this, and say *successfully* brought together. For, although there may be instances of success, as a whole, irrigation development, as a great economic progress, will fail if left wholly to speculative enterprise. This system also is open to abuse to that degree, and human nature, as represented by the necessary irrigators, is independent and perverse to that extent which will defeat enterprise, in the long run and broadly throughout the country, if it does not accept the protecting action of "control" and the smoothing influence of "association."

One would think by that we had by this time sufficient experience in irrigation development to make all parties concerned take an interest in the fundamentals of the problem, to show them that practice and action cannot with success fly in the face of principle, that mere temporary policy will not in the long run win. Irrigation enterprise is a most worthy class of effort; but it is a many-sided process, easily flanked. There is no single irrigation enterprise so good that it cannot be crippled by outside influence, if the management be not experienced, strong and wise, under any system of law or organization we now have. In another article on promotion, management and engineering of enterprises, I shall bring the general subject of Irrigation Principles to a close.

To be continued.

OFFICIAL REGULATIONS CONCERNING THE SELECTION OF DESERT LANDS BY CERTAIN STATES.

(UNDER THE CAREY LAW.)

SECTION 4 of the act of August 18, 1894, entitled, "An act making appropriations for sundry civil expenses of the government for the fiscal year ending June 30, 1895, and for other purposes" (28 Stat., 372–422), authorizes the Secretary of the Interior, with the approval of the President, to contract and agree to patent to the States of Washington, Oregon, California, Nevada, Idaho, Montana, Wyoming, Colorado, North Dakota and South Dakota, or any other States, as provided in the act, in which may be found desert lands, not to exceed 1,000,000 acres of such lands to each State, under certain conditions.

The text of the act is as follows:

Section 4. That to aid the public land States in the reclamation of the desert lands therein, and the settlement, cultivation and sale thereof in small tracts to actual settlers, the Secretary of the Interior, with the approval of the President, be, and hereby is, authorized and empowered, upon proper application of the State, to contract and agree, from time to time, with each of the States in which there may be situated desert lands as defined by the act entitled "An act to provide for the sale of desert land in certain States and Territories," approved March 3d, 1877, and the act amendatory thereof, approved March 3d, 1891, binding the United States to donate, grant and patent to the State, free of cost for survey or price, such desert lands, not exceeding 1,000,000 acres in each State, as the State may cause to be irrigated, reclaimed and occupied, and not less than twenty acres of each 160 acre tract cultivated by actual settlers, within ten years next after the passage of this act, as thoroughly as is required of citizens who may enter under the said desert land law.

Before the application of any State is allowed or any contract or agreement is executed or any segregation of any of the land from the public domain is ordered by the Secretary of the Interior, the State shall file a map of the said land proposed to be irrigated which shall exhibit a plan showing the mode of the contemplated irrigation, and which plan shall be sufficient to thoroughly irrigate and reclaim said land and prepare it to raise ordinary agricultural crops, and shall also show the source of the water to be used for irrigation and reclamation, and the Secretary of the Interior may make necessary regulations for the reservation of the lands applied for by the States to date from the filing of the map and plan of irrigation, but such reservation shall be of no force whatever if such map and plan of irrigation shall not be approved. That any State contracting under this section is hereby authorized to make all necessary contracts to cause the said lands to be reclaimed, and to reduce their settlement and cultivation in accordance with and subject to the provisions of this section; but the State shall not be authorized to lease any of said lands, or to use or dispose of the same in any way whatever, except to secure their reclamation, cultivation and settlement.

As fast as any State may furnish satisfactory proof according to such rules and regulations as may be prescribed by the Secretary of the Interior, that any of said lands are irrigated, reclaimed, and occupied by actual settlers, patents shall be issued to the State or its assigns for said lands so reclaimed and settled; provided that said States shall not sell or dispose of more than 160 acres of said lands to any one person, and any surplus of money derived by any State from the sale of said lands in excess of the cost of their reclamation, shall be held as a trust fund for, and be applied to, the reclamation of other desert lands in such State. That to enable the Secretary of the Interior to examine any of the lands that may be selected under the provisions of this section, there is hereby appropriated out of any moneys in the treasury, not otherwise appropriated, $1,000.

1. The second paragraph of the section requires that the State shall first file a map of the land selected and proposed to be irrigated, which shall exhibit a plan showing the mode of contemplated irrigation and the source of the water. In accordance with the requirements of the act, the State must give full data to show that the proposed plan will be sufficient to thoroughly irrigate and reclaim the land and prepare it to raise ordinary agricultural crops; for which purpose a statement of the amount of water available for the plan of irrigation will be necessary. The other data required cannot be fully prescribed, as it will depend upon the nature of the plan submitted. All information necessary to enable this office to judge of its practicability for irrigating all the land selected must be submitted.

2. The map must be on tracing linen, in duplicate, and must be drawn to a scale not greater than 1,000 feet to one inch. A smaller scale is desirable, if the necessary information can be clearly shown.

3. The map and field notes in duplicate must be filed in the local land office for the district in which the land is located. A plan and field notes covering tracts selected in several land districts need be filed but once in duplicate; one copy in the other districts will be sufficient. The map and field notes must show the connections of termini with public survey corners, the connections with public survey corners wherever section or township lines are crossed by the irrigation works proposed, and must show full data to admit of retracing the lines of the survey of irrigation works on the ground.

4. The map should bear an affidavit of the engineer who made or supervised the preparation of the map and plan, form 1, page 7, and also of the officer authorized by the State to make its selections under the act, form 2, page 7.

5. The map should indicate clearly the tracts selected, which must all be desert lands as defined by the acts of 1877 and 1891, and the decisions and regulations of this office therein provided for. The language of the former act, and the decisions thereunder, are as follows: "All lands exclusive of timber lands and mineral lands, which will not, without artificial irrigation, produce some agricultural crop, shall be deemed desert land." It is prescribed also as follows:

First. Lands bordering upon streams, lakes, or other natural bodies of water, or through or upon which there is any river, stream, arroyo, lake, pond,

body of water, or living spring, are not subject to entry under the desert land law until the clearest proof of their desert character is furnished.

Second. Lands which will produce native grasses sufficient in quantity, if unfed by grazing animals, to make an ordinary crop of hay in usual seasons, are not desert lands.

Third. Lands which will produce an agricultural crop of any kind, in amount to make the cultivation reasonably remunerative, are not desert lands.

Fourth. Lands containing sufficient moisture to produce a natural growth of trees are not to be classed as desert lands.

6. The map should be accompanied by a list in triplicate of the lands selected, designated by legal subdivisions. When a township has not been subdivided, but has had its exteriors surveyed, the whole township may be selected, but no patent can issue thereon until the land has been surveyed. This list should be dated and verified by a certificate of the selecting agent, form 3, page 7. The party appearing as agent of the State must file with the register and receiver written and satisfactory evidence, under seal, of his authority to act in the premises.

7. The lists must be carefully and critically examined by the register and receiver, and their accuracy tested by the plats and records of their office. When so examined and found correct in all respects they will so certify at the foot of each list, form 4, page 8, and number the lists in consecutive order, beginning with No. 1. The register will thereupon post the selections in ink in the tract book after the following manner.

"Selected ———, 18—, by A. B., agent for the State of ———, as desert land, act of August 18, 1894, list No. ———," and on the plats he will mark the tracts so selected "State desert land selection." After the selections are properly posted and marked on the records, the lists, papers and maps will be transmitted to this office accompanied by the evidence of the agent's appointment. It is required that clear lists of approvals shall in every case be made out by the selecting agents, if after the above examination one or more tracts have been rejected, showing clearly and without erasure the tracts to which the register is prepared to certify, also the aggregate area properly footed in the columns and set forth in the certificate.

For rejected selections a new application and a new list will be required, upon which the register will note opposite each tract the objections appearing on the records, and indorse thereon his reasons in full for refusing to certify the same. The agent will be allowed to appeal in the manner provided for in the Rules of Practice. Lists containing erasures received at this office will not be filed, but will be returned for perfection. Form of title page to be prefixed to the lists of selections will be found on page 8, marked A. On the map of lands selected the register will mark *rejected* such tracts as he has rejected on the lists.

8. To the list of selections must be added a contract of form 5, page 8, signed by the State agent authorized to make such contract.

9. When the canals or reservoirs required by the plan of irrigation cross public land not selected by the State, an application for right of way over such lands under sections 18 to 21, act of March 3, 1891 (26 Stat., 1095), should be filed separately, in accordance with the regulations of February 20, 1894.

EDWARD A. BOWERS,
Acting Commissioner.

Approved November 22, 1894.

HOKE SMITH,
Secretary of the Interior.

[The official publication contains blank forms as above referred to.]

THE IRRIGATION ENGINEER'S ANNUAL.

THE American Society of Irrigation Engineers has just published its first Annual, being the volume for 1892-93.

It contains lists of officers for 1891-92 and 1893-94, the constitution and by-laws, and alphabetical and geographical lists of members of the society. An account of the organization of the society prefaces the papers appearing in the book.

The first article is a paper by Samuel Fortier, Professor of Engineering, Agricultural College, Logan, Utah. This is on "Wooden Stave Pipe," giving descriptions of the pipes devised by A. V. Miller, of Salt Lake City, and by C. P. Allen and Chas. Owelle, both of Denver. These are illustrated. Formula for size and spacing of bands, estimates of cost, and specifications for material and construction are included in this paper, which is on a subject of general interest.

W. C. Parmley, now Assistant City Engineer of Peoria, Ill., follows with a paper on "Continuously Riveted Steel Pipe." This makes suggestions for specifications as to material, manufacture, etc., with formula for spacing rivets and other items of interest. Mr. Parmley has also "Notes on Sewers in Wet Trenches," containing considerable matter of value.

Hon. Ed. F. Hobart presents a paper on "A Reservoir at Santa Fé, N. M.," illustrated. This deals with the handling of flood water, with washing out silt from the bottom of the reservoir, and, among other matters, that of using a herd of goats to puddle the earthen dam.

Herbert I. Reid, City Engineer, Colorado Springs, and Norval W. Wall, City Engineer, Trinidad, Colo., each have papers on the disposal of sewage by irrigation at their respective towns (illustrated). These should be of value to towns and cities in the arid region.

Two papers on "Topographic Methods" follow: That of the "U. S. Geological Survey," by Arthur P. Davis, Los Angeles, connected with the survey; and "The Application of the Plane Table to Irrigation Surveys," by J. B. Lippincott, C. E., Redlands, Cal., the last being illustrated.

Henry P. Bell, late of Valparaiso, Chile, but now of Victoria, B. C., has a paper entitled "Random Notes on the Survey and Construction of Irrigation Canals." This gives an account of his methods in preliminary and location surveys; and also contains an account of a siphon pipe crossing a stream and ravine about 1,000 feet wide at top and extreme depth of some 350 feet. The pipe in this case is wooden stave, wire wound, bedded in concrete on the slopes of the

ravine, and double plate, steel, riveted pipe, supporting its own weight, and forming three spans of about 85 feet each across the stream.

P. M. Norboe, Visalia, Cal., writes on "Expensive Economy," as so often illustrated in the employment of cheap engineering and its accompanying evils.

Ed. E. Clark, Greeley, Colo., gives some of his observations and experiences in "The Operation of Irrigation Canals." Among other points, the frequent occurrence that a canal is turned over to the operating department unfinished, making it necessary to charge to operating expenses what should have been included in the construction account.

"The Necessity in the Engineering Profession for Closer Organization for the Purpose of Mutual Benefit and Support," is a well considered article by John C. Ulrich, Denver, Colo. All engineering societies are organized with this, as one object to be attained; and the American Society of Irrigation Engineers with special reference to men particularly engaged or interested in irrigation works.

Wm. G. Curtis, general offices S. P. R. R., San Francisco, gives a good paper entitled, "Irrigation in California: Its Connection with Material Progress and Transportation Problems." This shows the immense strides in the development of the citrus regions of California produced by irrigation, with some statistics bearing on the subject.

"Irrigation Canals in the Caucasus," translated from the French of Mons. N. Gherceranof, Director of Institute of Ways of Communication, etc., gives an extended account of surveys for and construction of canals on the slope of the Caucasus next the Caspian Sea. Mons. Gherceranof is a member of the American Society of Irrigation Engineers, as are all the contributors to the Annual.

"The Development of Water Supplies for Irrigation Purposes" is a paper by F. C. Finkle, San Bernardino, Cal. This takes up the questions of (1) storage reservoirs; (2) artesian wells, and (3) by underflow development, and gives some account of works of each class in California.

Mr. F. H. Newell, U. S. Geological Survey, gives an account of "The Rio Grande," hydrology, hydrography, results of gaugings, precipitation, run-off, etc., with graphic illustration of amount of discharge. This is in a line where practical results, giving valuable information, might be secured, if more general and continued gaugings of the principal streams in the arid regions could be carried on.

C. O. Smith, Visalia, Cal., in his paper, "The St. John's River Water Association, and the Improvement of Rivers to Economize Water and Benefit Irrigation," gives an account of a voluntary association of ditch and riparian owners and the Tulare irrigation district, on the river named and its tributaries, which has been productive of much good in the conservation, distribution and use of water.

"The Forestry Problem of the Arid Region," page 127, and "A Bill for the Cession of the Arid Lands," page 157, by Arthur D. Foote, ex-president of the society, Boise City, are both very pertinent to the subjects treated, and contain ideas and suggestions worth considering.

J. Sire Greene, late State Engineer of Colorado, presents a paper, "Concerning Rights in the Water of the Natural Streams of Colorado," in which suggestions are made, with a view of having a clearer definition in the statutes of the "right to divert," the "right to appropriate," and the "right to use" water from such natural streams. Some such modification would doubtless render the statutes more precise and more concise, a consummation devoutly to be desired.

This paper brought out an address by Hon. Platt Rogers, then mayor of the city of Denver, on "Vested Rights," and other legal aspects of these matters; see page 147.

The papers above mentioned are followed by "Sandgates in Canals," a discussion opened by Secretary Titcomb. This has some illustrations, and brought out the views and practice of a number of members "of how to get rid of sand before it goes too far down the canal." This and the discussion on "Flumes and Fluming" which followed were entirely off-hand, without special preparation. Each speaker illustrated his remarks on the black-board, and when that particular thing or phase was finished the figure was erased and another drawn, and so on. The most important of these were reproduced and appear as illustrations. The discussion on flumes and fluming was opened by John C. Ulrich, and with that on sand-gates occupied a considerable part of the time of the convention. The original stenographic report was largely cut down and condensed, but still fills about forty-five pages of the Annual.

The business proceedings of the convention and of the board of directors complete the volume.

It is proposed to publish such papers as are available periodically, perhaps quarterly. This would be a very desirable method to awaken and retain interest in the society.

AN IMPENDING REVOLUTION.

By W. C. FITZSIMMONS.

FOR the past twenty-five years the tendency of population in the United States has been toward the cities, towns and villages. The census of 1890 disclosed a far greater percentage of urban population, when compared with the whole number of people, than any preceding census. While such a movement of population has not thus far proven an unmixed evil, yet it has become evident that unless soon checked, the tide setting toward the cities must sooner or later effect the gravest economic complications, detrimental alike to the cities gaining an abnormal immigration, and to the country districts whence it is so largely derived. To the student of these conditions it has long appeared to be an unhealthy movement destined at no distant day to bring economic disasters of magnitude. That feature of the movement has undoubtedly been reached, in some sections of the country if not in all. But it is a law of nature that the incoming tide of the ocean must soon be followed by the outflow, and doubtless the surging of human masses may be to some extent at least governed by a similar law. In any event, a return movement is already discernible. Most of the larger cities and many of the smaller ones are enlarging

their boundaries, and hence acres are now sold at high prices per front foot where cheap farms could have been purchased a few years ago. This fact is due to the double action of the human tide. The inflow congested the cities and towns within their old limits, while depopulating the farms not only of America, but, unfortunately for us, of many foreign countries as well. Whatever the cause, the result has been to over populate the cities at the expense of the country to a considerable extent. It has been herein stated that this movement of population has not been an unmixed evil. One of the features most plainly observed has been to diminish the proportionate number of producers from the soil, and to increase the number of consumers. If this fact has not added to the general prosperity beyond that which would have resulted from more and better tilling of the soil by a greater number of workers, it has no doubt until lately, enabled soil tillers to find a better market for their products. But conditions have changed, and the idle masses in the cities must be redistributed. Not only this, but a general widening of the circle of urban life is certain to result from conditions and forces now existent and operative. All this is not only needful, but in the highest degree desirable on the score of material and moral wellbeing; and the primal causes which are destined to effect a peaceful and beneficent revolution in this direction are water and electricity. With water for irrigation of small tracts near great centers of population and business, and with electricity at command for reaching them, it is safe to say that hundreds of thousands, if not millions, of people, will avail themselves of the opportunities thus offered to breathe the pure air of the country and to enjoy more elbowroom than heretofore. There is something in the nature of every man which sooner or later tends to draw him from the overcrowded haunts of men to the quieter scenes of a rural environment. All men long for a home in the country, and it is the dream of most city men to one-day have a home—acre or more—where grass and flowers, and fresh vegetables and fruits may be enjoyed in the knowledge that they are the product of one's own land. Thanks to the science of irrigation and electricity, millions of day dreams of the past are now likely to prove substantial realities. The wonderful productiveness, natural or otherwise, of almost any soil properly watered and tended, has been so fully established in the irrigated regions that it has given a new aspect to rural life, and a thousand new hopes of human happiness are daily born of legitimately wedded land and water. The marvelous results achieved by tapping the great reservoirs of electricity have resulted in bringing a country residence fifteen miles from the city within a half hour's journey, thus separating home and business in a way most salutary to physical and mental health. Thus water and electricity are already at work changing for the better the relative conditions of urban and rural life. So easily and cheaply may electric roads now be built that they are pushing out in all directions from the centers of population and radically changing the relative aspects of city and country. In a certain sense the new devices in transportation have annihilated distance entirely and substituted for it the mere question of time. A business man who lives on his little irrigated five-acre plat, surrounded by all that is desirable in home life, is no longer fifteen miles, but thirty minutes, from his city office. A few years ago he was practically as far away though living on a narrow city lot only ten blocks distant.

Then, too, in addition to the highly advantageous widening of strictly urban and surburban lines, the electrical developments of the present time, added to the wonderful progress made in the knowledge of practical irrigation, largely through the influence of THE IRRIGATION AGE, have made the colony system of populating new regions, the recognized mode of establishing the most thriving settlements. Water and electricity thus act together to more equitably distribute population and the values of land, and easily and quickly accomplish what public disapproval of faulty municipal systems, and what paternal legislation of State or nation have never been able to effect. It is scarcely too much to say that no other human agency, operative during the past fifteen hundred years, has been so beneficial in its action and so comprehensive in its scope as the full development of the irrigation idea on conservative lines and the like development of transportation agencies through the medium of electricity.



HARVEST SCENE ON AN IRRIGATED FRUIT FARM IN IDAHO.

HORTICULTURAL MONTANA.

ARID AMERICA as a whole is a sealed book to the American people. A few of the more important valleys, such as the San Joaquin, and San Bernardino in California, the Salt Lake in Utah, and the San Luis in Colorado, are vaguely known in the populous East, but these are only a few among hundreds of valleys and it would be a rash man indeed who would dare to predict that they will be more important in the end than many that have scarcely been mentioned beyond the boundaries of the States in which they lie.

Montana agriculture has attracted little attention. Montana horticulture is utterly unknown. Montana is one of the Western States which enjoys a rather pleasing reputation so far as it goes. Its fame rests on its mines and its cattle. These are naturally the earliest industries in a remote mountain commonwealth. In the last few years, however, a new era has begun to dawn. It has come so gradually as to be almost imperceptible, even to the residents of the State itself. It is only on the occasion of an ambitious county fair that the agricultural and horticultural possibilities of a new country stand revealed. The exhibit of the Western Montana Fruit Growers Association at Stevensville last autumn was a complete revelation of the capabilities of the Montana soil and climate. It was a surprise to those who are familiar with the arid region, and would certainly be amazing to the great public which thinks of Montana as only fit for mining and cattle raising.

A TYPICAL MONTANA VALLEY.

The Bitter Root River is one of the many clear mountain streams which constitute the headwaters of the great Columbia River system. The Bitter Root Valley is a comparatively narrow strip of fertile soil, framed by rugged mountains. It is on the Western slope and for that reason has been considered more favorable for horticulture than the larger valleys on the East, drained by the Missouri River system. The town of Stevensville is situated near the centre of the valley, between Missoula, on the main line of the Northern Pacific, and Hamilton, the terminus of the branch line which penetrates the Bitter Root Valley. Probably no locality in the arid region shows more indications of thrifty development at this time. The valley ranges in altitude from 3,000 to 4,000 feet. The climate, of course, is that of the northern part of the temperate zone. The winter is long and cold, but the cold is of that peculiar quality so familiar to winter visitors to Colorado and other high altitudes of the arid region. The air is dry and crisp and the winter decidedly enjoyable. The fact that the cold is not of sufficient severity to do any injury to vegetation, or to impose discomfort upon man, is amply attested by the horticultural results exhibited on every hand. The Bitter Root Valley may be accepted as fairly typical of this portion of the West.

A MAGNIFICENT DISPLAY.

The fair at Stevensville was attended by crowds of people drawn from all parts of the State, and coming in special cars and all sorts of private conveyances. To tell the truth, Montanans were themselves amazed at what had been accomplished by those who had undertaken, in the face of much scepticism, to prove the possibilities of horticulture in this locality. Not until the products had been brought together in one exhibit was it possible for them to realize the facts.

One of the largest exhibits came from Pine Grove farm, of which the Bass Brothers are proprietors. Their collection showed 36 varieties of winter apples, six of fall apples, 7 of pears, 16 of plums, 12 of crabapples, two of grapes, with blackberries, currants and peanuts. W. B. Harlan's Como orchard displayed 56 varieties of apples, 34 varieties of plums, with crabapples and grapes. There were large exhibits also by A. Cave, Amos Buck, Thos. Burroughs, Robert Nicol, Roe Fulkerson, W. H. Franks, Henry Buck, John Hauf, and very many others. Mr. Hauf's exhibit of grapes was especially notable. He shipped 4,000 pounds of this product last year, realizing very good returns. Nothing short of a complete list of the exhibitors would really do justice to the occasion. The exhibit covered the whole range of hardy fruits and vegetables, and all were of the finest quality. Prof. S. M. Emery of the State Experiment Station declared that he would stake his reputation upon the statement that the showing had never been equaled at any county fair in the United States. The statement sounds extravagant, but the professor did not mean to say that the exhibit surpassed all others in variety, but in quality. And no one who has actually inspected the fruits and vegetables produced in Montana under a proper system of irrigation will challenge this statement. It is of no use to attempt to enforce the opinion by mere words. Such an exhibit must be actually seen to be understood and appreciated.

WHAT IT MEANS TO MONTANA.

The men of Montana, whose enterprise and labor made the Stevensville fair possible, have done far more for their State than those who discovered the mines, inaugurated the cattle industry, or built the railroads. This sounds, perhaps, like a radical statement now, but within five years it will be understood and appreciated. The Stevensville fair proves that Montana can support a great population upon the soil. Mining and railroad building will take care of themselves. The agricultural possibilities of a new country must first be demonstrated before the public will believe in them. This requires both pluck and patience. These qualities have been supplied and the results of their application prove the whole case for those who have had faith in agricultural Montana. There is no question but what forty acres of irrigated soil in the Bitter Root Valley, diversely planted and intensively cultivated, will supply all the needs of an average family, beside furnishing a surplus to sell. It is equally certain that the home markets, supplied by mining camps and railroad towns, will readily absorb the surplus. In these conditions lie the hopes of a large population for Montana. Outside of the State scarcely anybody believes in these possibilities. Within the State they are scarcely credited. But there is no room for doubt after such an exhibition as that at Stevensville last fall. This furnished the proof of all that has been claimed by the most enthusiastic friends of the new industrial life in Arid America. It is in just such valleys as the Bitter Root that the coming century will expend its genius and enthusiasm. It is here that, new forms of society and industry will be developed. If everybody in the United States had been permitted to see the fair at Stevensville there would not be cars enough on the Northern Pacific and the Great Northern together to carry the people into Montana in eager search for a chance to win independence through industry.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

Short, practical articles, notes of experience and observation, are invited from the readers of THE IRRIGATION AGE who are interested in the promotion of the idea of the small diversified farm providing to the fullest economical extent all of the various articles of food, clothing, etc., required by the family.

THE FUTURE OF FARMING UNDER IRRIGATION.

BY F. C. BARKER.

I HAVE been much struck by the fact that nearly all the California literature upon irrigated lands gives especial prominence to fruit growing, and the enormous profits to be realized thereby are the main inducements which are held out to investors. The promoters of irrigation in other parts have to a great extent followed this example. Little mention is ever made of stock and dairy farming, and yet, as I cast my eye over the great irrigated West, I find the most prosperous farmers are those who devote their energies to the raising of stock and dairy produce rather than to fruit.

Now, doubtless, the prospective fortunes to be made out of fruit are very dazzling to the uninitiated, and by the real estate agents are more easily compiled on paper than are the profits from stock, which latter are liable to be very sharply criticised by practical men, who know pretty well what a cow will produce, whether it be in Kansas or California. Besides, any idiot can see that a cow cannot be kept for nothing, whereas he may be deluded into believing that an orchard requires no such outlay for maintenance. All the estate agent has to do is to start with an imaginary price of two cents a pound for the fruit, then he figures out 86 trees to the acre, set out at 24x21 feet, and 500 pounds of fruit to the tree, and you have an income of $860 per acre before you know where you are, and all reckoned out to a mathematical certainity. Halve it, or even quarter it, and you will have a profit that beats all the old-fashioned ideas of farming.

Now, I am by no means depreciating the fact that fruit raising is the most profitable use to which irrigated lands may ultimately be put, but it has many drawbacks for the farmers as compared with stock raising. In the first place, the returns from an orchard may be very small for the first five or six years, and my experience is that the farmer who sets out an orchard rarely takes this into full consideration. He is apt to think that if he can only pay down the first installment on the land and buy the trees, he will be able to earn enough money to provide for the future by raising vegetables and poultry.

Now, if there is one department of farming that needs a long practical experience, it is the raising of vegetables. One may learn out of a book, or by taking advantage of the experience of one's neighbors, how to grow fruit trees, but the vegetable garden requires the exercise of intelligent and constant care. A tree will grow more or less if left to itself, but a cabbage or a cauliflower is by no means so accommodating, and it is only after two or three years of failure, or by an apprenticeship to a market gardener, that one learns to master the many petty details of the vegetable garden. As regards poultry farming, everyone who has tried it finds out sooner or later that, while a small flock of twenty hens may pay a yearly profit of $40, it by no means follows that 200 hens will yield $400. Indeed, it is just possible that 200 hens may not give as much net profit as twenty.

Thus it frequently happens that the fruit farmer finds himself crippled for funds, and he is unable to give to his orchard the care and attention which it needs, and the whole enterprise becomes a failure.

Far better results are obtained where the farmer devotes his land mainly to alfalfa, with a portion sown to corn or sorghum, to feed with the alfalfa in the shape of fodder or ensilage. Not only can hogs and dairy cattle be fed in this manner at less expense on an irrigated farm than on the old-fashioned farm, where irrigation is not practiced, but the products are invariably worth in the arid West from 40 to 50 per cent. more than in the Eastern States. The mild climate is another great advantage in favor of the Western farmer, as cattle and other stock do better and need less outlay for shelter than in cold climates. It is also an important point that the experience gained by the stock grower in the East will, with slight variations, apply equally well to the West, whereas the fruit grower or market gardener coming out from the East will find the climatic and other conditions so different here that he will practically have to unlearn a great deal that he knows. But the great advantage which the stock farmer has over the fruit raiser is that he begins to make a profit from the very start.

It is a noteworthy fact that in the Santa Clara valley, one of the finest districts of all California, the most prosperous farmers are those who make cheese, and not those who grow fruits. In Arizona, Professor Gully, late director of the Arizona Experiment Station, was telling me the other day the alfalfa farmers are the best off, while here right at home I notice that the men who have made the most progress grow alfalfa and raise hogs. Raising hogs may not be so romantic and attractive as peach orchards and orange groves, but the profits are surer and quicker.

The fact is that the great future for stock raising on our irrigated lands is by no means fully appreciated, but I am convinced that when practical farmers take the matter in hand they will find they can raise beef, mutton, butter, bacon, eggs and poultry at less cost than in the Eastern States.

Home grown cattle now supply the demand in Washington and Oregon, and the farmers have gone into the raising of hogs on a large scale during the past year. Experts say that the next year they will have beef and pork to ship to Montana and Idaho. The significance of this lies in the fact that Washington alone sent $3,500,000 East during 1894 for pork products.

SOME PRACTICAL POINTERS.

BY J. C. FORTENER.

THE apple crop of the year 1894 was very large in the Eastern part of the United States, but it is surprising to find that there are practically no fine apples, as judged by the standards of the irrigated regions, in the Eastern markets. A visit to the largest groceries and fancy fruit stores and to South Water street in Chicago failed to disclose any exceptionally fine apples, with the exception of a few King of Tompkins and Ben Davis. While the market quotations are $2.00 to $3.50 per barrel of 150 lbs. fair size sound apples that would pack four rows to a tier, four tiers to a California, Oregon or Washington apple box, are firmly held at $5.00 per barrel, and South Water street commission men informed the writer that choice red apples of the above described size would bring $2.00 per box of 50 lbs. Holders of really fine apples can confidently expect very high prices in the spring of 1895, probably as high as in 1894, when for a couple of months such apples sold at $8.00 per barrel and upward, and a few sales were made at $25.00 per barrel.

Owing to the high freight rates the growers in the irrigated region cannot ship probably until spring, and the preservation of fine fruit by cold storage is plainly pointed out as being a most profitable business.

Refrigerating machines are now made with a capacity of cooling from one car load up: they can be run profitably by water power, and with turbine wheels can be installed for $1,000 in addition to cost of building.

An Overload of Debt.—As showing the enormous amounts invested by British capitalists in Australasian enterprises, Consul Bell of Sydney, alleges that the various sums borrowed within the the past few years by Australasian Governments and people aggregate the stupendous amount of $1,946,000,000. This indebtedness appears the more remarkable when we consider that the entire population of the countries involved is less than 4,000,000—not equal to that of the State of Pennsylvania in 1890. At an interest rate of four per cent only the annual interest charge on this indebtedness would be $20 per capita of the entire population, or say $100 to each family. The entire wealth of Australasia is given by good authority at $6,703,018,000; hence it appears that Great Britain has a mortgage on the colonies amounting to nearly one-third of the entire wealth of the Australasian continent. But in spite of this enormous indebtedness and the crisis of last year, our consul writes, that business is fairly good, and that confidence is generally felt in the banks and in the governments. In giving the causes of this speedy recovery from a most distressful condition Mr. Bell says: "But it must be remembered that, from the beginning, the governmental policy of the colonies has been more socialistic than in any other country, and many of the public utilities have been created and remain the property of the government. These public utilities, so indispensable to the growth and prosperity of the country were created by borrowing, as the industrial conditions of the country would not have justified their construction by private enterprise.

King corn finds its royal prerogatives disputed by cheap wheat from the West, cotton-seed meal from the South, linseed meal in the central section, and alfalfa on the irrigated farms. They are all proving o be effective substitutes.

Keeping Cabbage from Bursting.—A little information which ought to be of great value to irrigation gardeners is given by a contributor to the *National Stockman*. He says that the bursting of growing cabbage heads may very readily and easily be prevented simply by selecting the heads which show signs of bursting and starting the roots by pulling, or cutting off some of the roots with a hoe. The pulling process is declared to be preferable. The writer says: "Putting both hands under the head I pull until many of the roots are loosened and then the plant is pushed over to one side. This treatment effectually stops the bursting, and not only that but the cabbage continues to grow lustily, and I have had the gratification of seeing heads thus treated grow to double the former size and weight, and all due to this starting the roots which checked the growth enough to prevent bursting, but not enough to hinder further development. There is no excuse for allowing cabbage to burst when so effectual means is at hand to prevent it."

Need of Full Information.—In some parts of Oregon it is reported that a considerable number of hogs have been fattened on wheat bought at 22 cents per bushel, and the hogs sold at 3¾ cents per pound on foot. This is certainly a good business if properly conducted, for it has been shown in a number of cases that wheat is worth for swine feed fully twice that price with pork at present values. It is the farmer who reads and profits by the successes or failures of others, who eventually scores the most substantial results in his calling. Every rural reader of THE AGE should keep fully abreast of the times by a careful perusal of all that pertains to his business, and by making experiments and ample notes for his guidance in the future. While it is not pretended that THE AGE knows all about farming and fruit growing, it certainly does teach from month to month a great deal which no agriculturist or horticulturist can afford not to know. It will be the constant aim of this journal to present from month to month such hints and suggestions of a practical nature as will enable any soil tiller anywhere in the country to derive at least some advantage from its careful perusal. Facts and figures will be presented showing results achieved or achievable, and the commercial side of agriculture and horticulture will be made prominent. Soil tillage as a business in these days is largely a question of manufacture and sale, and to do all this with the highest success, or even with moderate success, the husbandman must keep fully informed as to markets and products, not merely locally but on a broad scale; often covering the entire country, and at times the world. The time has gone by when the farmer may safely rely upon his pastor or grocer to tell him what to do with his crops when produced or even the best methods of producing them. It is as necessary for the men who till land to know what the best talent in their business has accomplished, as for the lawyer to know what judicial decisions in the past bear upon the case on hand. While THE AGE is primarily a journal for the guidance of the irrigation farmer, it will be found worth many times its cost to any farmer who gives its pages proper attention. The writer is in possession of facts which show conclusively that a direct profit of hundreds of dollars has been made by a single reader following certain suggestions contained in a single number. The practical nature of nearly all information conveyed in these columns adds very greatly to its value. Mere theorists are not heard in this journal, and those interested are

requested to give full tests to any suggestions which to them appear unusual or doubtful, and report results. While we cannot expect always to be in the right, the conditions under which all matter appears in this magazine are such as to afford a more than usually safe guarantee that it is of specific value. Covering so wide a field, it may sometimes happen that local questions may not be treated with entire accuracy, but the utmost care is exercised to make THE IRRIGATION AGE authority in a general sense in every part of the world where it finds its way among the hardy sons of toil. There is no other journal published which in its peculiar field approaches the standard set for THE IRRIGATION AGE, and it is the purpose of the publishers to keep it always in the front rank of journalism.

A Texas Example.—J. W. Stuvenrauch, of Mexia, Texas, writes that he has been irrigating six or eight acres of garden for three years past, and is greatly pleased with the venture. The land is rich, water is plentiful, and he grows two or three crops a year, for which he has sufficient home market. He is just now selling rutabaga turnips to the stores at the rate of two cents a pound, many single turnips selling for from ten to fifteen cents. He may well say, "Strange, is it not, that three or four turnips should sell for as much as does a bushel of wheat?" He is not willing to tell how much they have realized off an acre of ground, but with cabbages at five cents a pound, lettuce at five cents a head, and turnips at e price named above, it ought to be considerable.

Hogs on Alfalfa.—Gilbert Brothers, of Ford County, Kansas, say "that alfalfa will pasture twenty-five hogs per acre, and it requires but a small amount of grain to put them in fine condition for market. We have about $2,000 worth of hogs on hand now, and the cost of production has been very light. Have wintered hogs successfully on alfalfa hay and water, but this winter we shall cut everything that we feed to stock of any description, and mix a little ground feed with it. All of our straw and fodder of every kind will be fed in this way, and we think it is safe to say that enough fodder is wasted every year in Western Kansas to feed the stock now there."

Farmer's Bulletin, No. 23—From the U. S. Department of Agriculture, is an exhaustive treatise by Prof. W. O. Atwater, of the Wesleyan University, on "Foods: Nutritive Value and Cost." It is announced as the first of a series of popular bulletins on the nutritive value and economy of common food materials. Application for these Bulletins should be addressed to the Secretary of Agriculture, Washington, D. C. They are well worth sending for.

A Scourge of Wild Horses.—R. L. Fulton is authority for the statement that 200,000 wild horses are roaming over the ranges of Nevada. They are causing the ranchers great trouble, and as the law authorizes the shooting of wild stallions the cowboys shoot them on sight. They are being utilized for hog feed, and are estimated to be worth $7 a head for that purpose. They are eating off the grass from the ranges so that cattle and sheep owners are having a deal of trouble by reason of it.

Eradicate the Russian Pest.—Half-way measures will have but little effect in ridding the country of the infliction which it is now experiencing from the Russian thistle, or cactus. Legislation, except it may be to compel united action on the part of farmers, land owners and railway companies, will have but little influence. It must be exterminated root and branch. Clear a township and leave a square rod of it on the border, or permit a single plant to roll in from the next county, and the labor will be lost. Its power of reproduction is something phenomenal. The dry plant, breaking away from its roots, rolls across field like the tumble weed, and its trail may be followed for miles if it meets no obstruction. It scatters seeds by millions and they germinate with the slightest opportunity. There must be a relentless and unceasing war of extermination, and when it appears in a neighborhood, the sooner the forces are organized to destroy it the easier will be the task.

What Boys Should be Taught.—An excellent suggestion is contained is an essay recently read by Rev. E. P. Powell before a farmers' institute at Clinton, N. Y. He said:

"And here we are met by the fact that American education was never intended for the agriculturist. It grew out of European education and took its shape from old medieval notions. It put geography, grammar and arithmetic to the front, just as a little higher up it placed Latin, Greek and rhetoric. Now on the land we have to deal with something those studies do not touch. We are consumed with bugs and blights and droughts; we deal with trees and plants, with flowers and fruits and vegetable life in general, with animals and soils, with rocks and water courses. What we want taught to our children is not the geography of India or even Indiana; but a knowledge of the things under their feet and all about them.

"They should begin with geology, a knowledge of the soils; and chemistry, a knowledge of waters and minerals. Entomology, botany and zoology are farm studies, and if our young folks can have these they can get not only a living off the land, but will be so much at home on the soil that you cannot induce them to leave it. This will come. We shall see our common schools readjusted so they will stand in gardens, and half of each day will be given to the study of things and the other half to books."

The Dairy Cow Sized Up.—A cow whose milk will make a pound of butter a day, or 350 pounds in a year, is a very good cow and would yield a profit after paying for a liberal feeding. One which yields 300 pounds a year is a good cow and probably a profitable one; and one that yields 250 pounds a year may pay for her keeping and care, but one that does not yield over 200 pounds a year is a poor cow, and does not do any more than pay for her feed at the average price of butter and of feed.—*Southwestern Farm and Orchard.*

Cost of Alfalfa Hay.—The big alfalfa growers of Colorado estimate that they can put up hay at 75 to 85 cents per ton. Of course they use the most economical machinery and the hay is stacked on the field so as to avoid a long haul. At this rate the farmers can make a good profit, as alfalfa hay can be sold to cattle feeders at $4.00 per ton in the stack.—*Exchange.*

It Pays to Feed Wheat.—Mr. Lewis Graham, Jackson township, Cass county, Ind., weighed on September 5, twenty-two March pigs, 2,690 pounds. Fed 30 bushels wheat, ground and fed dry in trough. The pigs had run on clover. At the end of fifteen days they weighed 3,235 pounds, making a gain of 545 pounds, which at 5 cents per pound is $27.25, or 90.83 cents per bushel, less 5 cents per bushel for grinding, nets 85.83 cents per bushel for 46 cent wheat.

A Nebraska Protest.—Buffalo County people protest against the affidavit required to secure a share of the free supplies, donated to drouth sufferers, on the ground that it is humiliating and is in effect an admission of pauperism. Such donations usually lead to bitter heartburnings, and pitiful as are the sufferings which they are intended in good faith to relieve, the results almost uniformly cause misgivings on the part of the donors as to the wisdom of their action.

New Methods of Handling Fruit.—There are improvements and changes in the conduct of all industries, new machinery and new processes facilitating and cheapening production. The improvements in fruit handling and shipping are of as vital importance as any perhaps. Carbonic acid refrigerating is now contesting actively for the precedence over iced cars, avoiding delay, and, it is claimed, reducing the expense. Sterilizing, to prevent decay is another claimant for the public attention, and if successful as in other directions might work a great benefit. California is naturally leading in every class of experimenting. The advantages of extending the market can hardly be over-estimated.

Fruit Selection.—An idea which was quite generally prevalent at one time, that fruit grown by irrigation would be inferior in flavor, less compact, and less desirable for keeping and shipping has been exploded by experience. On the other hand, irrigation at proper seasons and intelligently applied, enables the production of a better fruit in all these respects. All fruits are not, however, equally adapted for every locality and the varieties should be very carefully chosen. It requires three or four years to test most fruits, and a bad selection at the outset involves great loss and disappointment.

Fruit Exchanges.—By the organization of fruit exchanges in the principal districts of California, the growers thought they had accomplished the purpose of marketing their fruit more advantageously and economically. They found sales at auction in the market centers to work satisfactorily for a while, but the dealers have formed a counter combination and exclude all but members of their association from the auction room. There appears to be no other recourse except to extend their operations so as to reach the consumers directly.

Orchard Profits.—Judge W. B. Felton has furnished us with figures relative to his orchard for 1893. All his crop was sold before November 1st.

Cherries	$ 3305
Pears	174 16
Grapes	222 06
Apples, early	160 86
Apples, late	5777 59
Other fruits	187 38

Total, $6,555.13; expenses, $1,535.87, leaving a net profit of $5,019.26. Less than nine acres are under cultivation, five of which are planted to winter apples (paying $1,155.51 per acre); except apples everything was a short crop. There are many larger orchards in Fremont County which are wonderful producers; but Judge Felton believes "Ten Acres Enough" for any man; and the way he conducts his place and his success with it in the past few years would indicate that he is not far wrong.— *Canon City (Colo.) Record.*

Straw a Substitute for Hay.—Bulletin No. 35, of the Utah Experiment Station, treats of, first, the value of straw as a substitute for hay; second, short spring periods of grain feeding; third, relative value of ensilage, roots and straw as condiments; fourth, value of different grain rations. The following facts are brought out in the bulletin:

1. Steers fed on mixed hay alone for 112 days gained 1.09 pounds per day each.
2. Steers fed straw and hay, with grain, gained .78 pound per day each for thirty-three days. Steers fed on lucerne and straw for fifty-six days gained practically nothing. Steers fed on red clover and straw for twenty-three days gained .56 pounds per day each.
3. Steers fed on grain and straw for 112 days gained .33 pound per day per steer.
4. All the steers, after having been fed as specified in paragraphs 1, 2 and 3, gained but .34 pounds per day each for thirty-five days on mixed hay, grain and roots. The smallness of the gain is thought to be due to the change of feed.
5. Steers housed at night and in yard during the day, when fed on hay and grain, and either roots, straw or ensilage, gained 1.35 pounds per day each for eighty-four days.
6. The experiments indicate that any attempt to crowd a steer late in the spring, after he has been moderately well fed, will result in a loss.
7. Roots made more gain than either straw or ensilage.
8. As the amount of grain fed increased the growth increased and the cost of the gain decreased.
9. Steers bought at 2 cents and fed in the manner indicated during the winter, cannot be sold at a profit in the spring for less than 3 cents.

The European Wine Industry.—To give an idea of the wine industry in foreign countries it may be stated that France cultivates about 4,550,000 acres of vines, Italy 8,600,000 acres, Spain 6,200,000 acres, and other European countries perhaps 5,000,000 acres. The largest producers of wine are Italy, Spain and France. Twenty years ago France led all other countries, and in 1874 her vintage was reported at 1,800,000,000 gallons. But the disease known as phylloxera attacked the vineyards to such an extent that the enormous output of 1874 has never been duplicated, although, thanks to the reestablishment of many vineyards by grafting upon the roots of the American wild grape, last year the vintage rose to 1,125,000,000 gallons— a quantity thirty-seven times greater than the vintage of the United States in any single year.

Pruning the Peach Tree.—Summer pruning of peach trees is recommended by many advanced orchardists. It should be remembered that peach buds live but two years, and the utmost care should be taken therefore not to so trim the trees as to preclude the possibility of bearing from a dearth of buds. A careful system of pinching back in summer from the early growth of the tree will generally effect good results in keeping the tree near the ground and well supplied with good, strong branches able to bear and properly mature a heavy weight of superior fruit.

Prof. Henry says a ton of butter, worth $400, contains fertilizers worth not more than fifty cents, while a ton of cheese worth $60, contains $1.70 worth; a ton of wheat worth $20, contains $7.75, oats $7.43, and barley $7.99.

THE QUESTION BOX.

The Question Box shall be an "open parliament" for the discussion of the practical, every-day questions that perplex the irrigation farmers. Questions will be answered by those men of long experience among our readers who are glad to give of their knowledge for the common good. Further answers are solicited from any reader whose experience differs from that published here. The editors reserve all rights of control of the department.

What do you *know* of the new forage plant, sacaline, which is being offered by "THE AGE" and by many of the agricultural papers? If the claims made for it are fully true, it has some of the distinctive elements of the worst pests the farmer has to deal with.

THE AGE is on the alert to discover such plants as are best adapted to the intensive culture incident to farming by irrigation. A proposition came from the seedsmen, A. Blanc & Co., which was taken under consideration, and as it appeared to be well indorsed by responsible parties an offer was made which would enable our readers to test its value. A recent letter from the above firm is calculated to excite suspicion, and as it has evidently been sent in about the same form to all publishers our readers should ponder it carefully so as to avoid the risks involved. They say:—"It has been stated by W. Atlee Burpee & Co. of this city, that the plant could not be eradicated. We have written to a number of parties who have grown this plant as an ornamental for several years in this country, and, without a single exception, we have been assured by them that there was no trouble in eradicating it except in very rocky ground. The plant, as you know, makes roots like asparagus, and also sends down deep tap roots. Near the surface of the ground it makes long runners, which in time root again, and from which the plant is thus propagated. If, however, the main crown is cut below the soil, the tap root will not grow again, and by lifting the main crown the running roots are taken up also. We are also told by parties who have grown it for years that by plowing it under and growing on the soil some crop that requires cultivation the sacaline is effectively eradicated; as the plant has never produced seed in this country it cannot spread from that source. From our own experience we would say that we have tried to propagate from the tap roots and utterly failed to do so."

Without considering these points *seriatim*, we are disposed to believe that any man who has fought the spread of Johnson grass will recognize enough similarity in the habit of root growth to cause a prudent hesitation about giving this a foothold in garden or field. THE AGE has withdrawn its offer as to the distribution of the seed, although it will send a small package with caution as to planting it to those who have made claim for it. There is food for thought in the following from the *Nebraska Farmer*, signed by J. M. Rice, Winview, Okla.:—"I expect to try it, as I do most of the forage plants. But I want to caution farmers as to the unthoughted planting of it. Just read what is claimed for it, and then if you think it is the thing for your farm try it on a small scale. But notice that it is claimed that neither drouths, floods nor fire will destroy it; that the roots take possession of the ground; grows fourteen feet high, and that cattle cannot trample it out. If these things be true, and that it spreads by its roots, might it not be a pest which you could not get rid of? Then if it produces 180 tons of forage per acre, are you prepared for handling even one acre of it. I of course know nothing of it. Almost every seedsman has seeds and roots for sale, and their descriptions are almost identical, scarcely any variation except in details. So far as I have been able to gather, it has not been tested in this country except as an ornamental plant. I think seedsmen should have given it a thorough test before offering it for sale."

Crops for Young Orchards.—A. D. T.—Please inform us new beginners what hoed crops may be grown at a profit in a young orchard. How about strawberries? May other roots than potatoes be cultivated without harm to the trees?

Better Without.—The best crops to be grown in an orchard at a profit are such as can be marketed with or at good prices. If any can be grown in the orchard without injury to the orchard, I have yet to see them. No crops whatever should be grown in the orchard, from the fact that the trees need all the fertility for their own growth. But if you are determined to grow something in your orchard, let them be "hoed crops" by all means—never small grain or grass, clover or alfalfa.—A. E. BLOUNT, Las Cruces, New Mexico.

Another View.—Young orchards need good nursing to insure quick returns and fruitfulness. Well-hoed crops will add rapid growth, strength and beauty beyond ordinary methods of cultivation. Strawberries and blackberries, Irish and sweet potatoes, cabbage, butter beans, or navy beans may be grown in an orchard the first four or five years. They do not exhaust the fertility and moisture of the soil as grain crops do. The largest summer growth I ever saw on peach trees was in a strawberry patch I set out in the spring of 1869. It was hoed once a fortnight until the middle of September. A rank growth of purslane which got a start during a day or two of wet weather was pulled and piled around the young trees, the result showing it to be a good fertilizer. Nearly all kinds of young fruit trees will grow more thriftily in a raspberry or even a blackberry patch if well cultivated. I have a young orchard now growing in a strawberry patch in better condition than any other orchard of its age in the county. I have also a plum orchard and a few standard pears, set in 1889, in a blackberry patch that have made a remarkable growth. The pear trees were standards, inferior and unsalable, and I set them there rather than throw them away. I had no idea they would attain their present size in six years. Raspberries and blackberries protect the body of the trees on the south and southwest side in the hot July and August season. Rotation of crops is advisable. Two or three crops of strawberries is all that should be grown in an orchard before changing crops, and all straw and dead leaves should be burned to destroy insects. Sweet potatoes is a good following crop, for which the ground should be well prepared. If the ground is dry, a pint of water with each root at the time of planting will insure a set. A profitable crop of sweet potatoes can be raised after the berry crop has been harvested. From one and a half acres of an old berry patch I harvested four hundred bushels of large early Nansemond potatoes the last year, besides a lot of small unsalable potatoes fed to calves and chickens. The ground was set between the 6th and 10th of June with 12,000 plants costing $1.00 per thousand. Sweet potatoes may be followed by Irish potatoes and buckwheat, and ploughed in the following year, and then may be planted to strawberries again. By the time the two crops of strawberries have been harvested the orchard will be six or seven years old, and ready to go it alone, paying its own way. It is a mooted question upon which orchardists do not agree as to the culture of an orchard. It is my opinion that a crop of clover, followed by buckwheat and rye, and

ploughed under while in the green stage, is a good thing to help the fertility of the orchard.

My specialty is small fruit culture, in which I have been engaged twenty-eight years. If I had a young apple or pear orchard of one thousand or ten thousand trees, I would practice the above order of rotation as nearly as possible. I would not grow corn or small grain in an orchard. A peach or a plum orchard grows so as to shade the ground much earlier, and being planted nearer together not more than two crops of strawberries could be grown on the ground profitably.—B. H. SMITH, Lawrence, Kans.

About Small Ditches.—C. T. N. and Others.--What is the capacity of small ditches at different grades? Reference is made to the farm laterals. What method of management of ditches is most economical of labor to keep them in order and distribute the water?

C. T. N. asks a question that admits of as many answers as there are kinds of soil, width of ditches, and manners of letting the water into the laterals. With a five-inch pressure the water on a level will carry itself at very different velocities over the bottom of the ditch, over some very slowly and over others more rapidly, owing to what kind of soil the bottom is made up of. Over clay it will run faster than over sand or drift soil. When the grade is one-tenth of a foot in 100 feet, the velocity of course is greater than when on a level; but there is no definite rule, only a general one to ascertain what that is.

In boxes made of wood or iron these matters can be given quite accurately, but not in soils.

Second, in order to throw the water out of a lateral at any given place, the best way is to throw a blanket across to stop the water, and then by this let the water out over the sides through small and shallow cuts. The blanket is made by tying a gunny sack over a pole at one side, and when it is thrown across the other side is let down into the bottom of the lateral and secured by throwing dirt upon it.

A. E. B.

Tree Protectors.—A. G. L.--What is the best protection to prevent rabbits eating the bark, and in many cases girdling and destroying the tree?

The trees may be wrapped with bagging, stalks or paper to prevent reaching the bark, but this is expensive and requires great care to be fully effective. Wire netting around small fields or gardens can be used to good advantage, but around large fields they are not always satisfactory. The industrious and persistent animals will find an occasional weak spot, or soft spot, and a single one can do a deal of mischief while you are resting in fancied security. A wash made of strong soap suds—say two pounds of soap to five gallons of water with the addition of sulphur when it is boiling—may be easily and cheaply applied. If used twice a year—spring and fall—the trees will hardly be troubled by any sort of vermin.

C. W. G.

MAXIMS FOR THE IRRIGATED FARM.

A TWO-LINE fact, simply stated, will often stimulate thought more than a column-long treatise. These brief sentences are intended to be suggestive—a condensed expression of accepted truths and wise precepts.

You can use too much water. There is little danger of too much cultivation.

Those serve God best who watch as well as pray, who combine faith and good works.

True, a woman can make more money with three plug chickens than a man with a dozen thoroughbreds.

It is queer, but the blackest hens lay the whitest eggs—most valuable in the market.

A bushel of wheat will make seventeen pounds of pork; a bushel of corn fourteen pounds.

The successful dairyman must have confidence in himself and faith in his cows.

Every little fibrous root is a suction pump, sucking up moisture from below.

Don't expend too much in repairing a rattletrap of house or barn. Better build new.

The highest grades of product yield best returns. There is always room at the top.

It is no fault of the cow that farm values have fallen. She has held her own.

Don't venture on an uncertain distant market when you can get a fair price at home.

It is more satisfactory to buy wheat by actual weight than by measurement.

Sugar beets are good food for sheep; mangels are better.

Feeding farm crops to sheep on the land is best means for restoring fertility.

Breeding ewes kept in good flesh during winter will produce better lambs for it.

Hogs and alfalfa fields are a safe reliance on the irrigated farm.

Keep always ahead of your work. Be fully ready when spring opens.

A sharp plow point saves horseflesh and adds a large per centage in results.

He who plants and cultivates just at the right time is most certain of a good harvest.

There has been a greater reduction in the number of sheep producing wool than of people to wear it.

A good time to buy sheep—or anything else—is when prices are at the lowest.

Good judges are taking a hopeful view of the prospect for the sheep industry.

Is life worth living? Yes, on a well-selected, well-cultivated irrigated farm.

One man works with a will and is happy. Another, lacking heart, is forever facing obstacles.

Plant your peach orchard in a good loam soil, well drained, with northern exposure.

Extermination of affected trees, root and branch. is the only known remedy for peach yellows.

It is the wise stockman who makes liberal provision to feed with alfalfa at critical periods.

The grower of two acres or more of strawberries can afford irrigation to insure full crops and fine berries.

Dairy cows are benefited by sun-lighted, well-ventilated stable accommodations.

Grow for the home supply first; for the market afterward.

Fencing kept in good repair saves loss, annoyance and anxiety.

Plenty of good reading in the farm home will help to keep the young folks contented.

Windbreaks judiciously planted add greatly to the comfort and attractiveness of the farm home.

Plant your orchard in the best soil on your farm, if you wish largest returns from the investment.

Paying the road tax in labor is false economy. Cash buys good machinery and hires good workers.

The first requirements for good roads—solid foundation and perfect drainage.

Geese breeders for profit use old geese (they never get too old), and young ganders.

The smaller animals of a herd need protection from the strong and greedy, when in the fattening yards.

The cow pea is the Southern sheet anchor for fodder, seed and fertilizer.

Farming by irrigation demands the highest grade of intelligence and good common sense.

Common sense and the use of tools make a good mechanic of a good workman of any class.

That country is most prosperous where its natural adaptations are closely studied and recognised.

Present low prices are abnormal; they will be a recovery when the producing causes are removed.

The real teachers of the world employ plain, simple language; then everybody can understand.

A great battle is on in the Senate: Meat Trust vs. Sugar Trust. Germany is in it.

Men who boast they never read a newspaper are generally heralding their own lack of brains.

Man is constituted to overcome difficulties. Adversity is a better teacher than prosperity.

You cannot grow good pork from a weak, sickly pig.

It matters not whose ideas are used: a hog grower should know his business thoroughly.

The comfortable sheep, pig or cow, keeps better on less feed than the uncomfortable one.

"We live not upon what we eat, but upon what we digest."

Whoever attempts deep well drilling with light and cheap machinery wastes time and money with failure almost a certainty.

A correspondent suggests that the arid end of the semi-arid teeter-board is down more than half the time.

Windmill irrigating may be more expensive but, it is more satisfactory as well.

During winter your hens will appreciate a warm breakfast, and will give you more eggs.

Warm farm buildings add to the comfort of your stock and save feed.

Warm buildings will save many bushels of grain and tons of hay. Money saved is as good as a dividend paid.

It costs less to hold animals in good flesh than to replace it after a season of shrinkage.

It never pays to breed scrub stock of any kind.

Feed your hens warm food, in variety, and give them comfortable quarters; then you may expect a good supply of winter eggs.

Comfort and beauty may be combined in the construction of farm buildings, but comfort should be the first consideration.

PULSE OF THE IRRIGATION INDUSTRY.

A NORTHWESTERN NURSERY.

The supposable cold climate of the far Northwest prevented any early broad development of the nursery business in that region, notwithstanding the wonderful reputation which the fruits of Oregon, Washington and Idaho have achieved during the past few years. One of the earliest established, and now the largest nursery in all the Northwestern country, is that of C. L. Whitney, at Walla Walla, Washington. During a recent visit to Mr. Whitney's place, the writer was much impressed by the sound horticultural basis that underlies all of Mr. Whitney's operations. The establishment covers about 100 acres of fine bottom land. Land of similiar quality in the vicinity is now worth $300 per acre for fruit growing and gardening purposes. The stocks now on hand include some 200,000 apples, 75,000 peaches, 75,000 pears, 200,000 prunes, and another 100,000 of miscellaneous species, including apricots, cherries, nectarines, etc. In addition there is a large stock of roses and other hardy ornamentals. The varieties of apples in most demand for the planting of the numerous new orchards among Mr. Whitney's customers are about as follows, in the order named: Ben Davis and Yellow Newton Pippin east of the Cascade range, and on the west of the mountains the Baldwin and Northern Spy are leaders. Then in order are Esopus Spitzenburg, Winesap, Jonathan, Blue Pearmain, and Red Cheeked Pippin. Although the Ben Davis is a discredited apple among lovers of fine fruit, yet more trees of this sort are planted in all the Western country than any other variety. This is due to its superior keeping qualities, perhaps due to its tough skin, the extraordinary vigor of the tree and its early maturity, coming into bearing the third year. There is an increased call now, Mr. Whitney states, for those other excellent varieties, the Mammoth Black Twig, the Arkansas Black, and the York Imperial. A remarkably fine new variety, destined to have a popular future, has been aptly named Washington, as it originated in Walla Walla. It is about the color of the King, while being shaped something like the Northern Spy. It is sub-acid in flavor, of fine grain and an excellent keeper, and of quite as much importance is its enormous size, growing as large as the light-skinned Gloria Mundi. These, of course, are all winter varieties, the early sorts being little in favor among Northwestern apple growers, because they are easily beaten in earliness by the California fruit men, who, however, cannot compete with the superior quality of the winter apple of the Pacific Northwest. The planting of winter apples is going on at a great rate in that section, and it is creditably stated by one of the boards of horticulture that 6,000 to 10,000 acres are being planted each year in Washington alone, and Mr. Whitney's orders show a marked increase from year to year, although indeed this is somewhat due to the broadening of the territory into which he is sending his well-reputed stocks. His orders now come from nearly all of the arid region, and hundreds of THE IRRIGATION AGE readers in Idaho, Montana, California, Utah, Colorado and New Mexico are now numbered among Mr. Whitney's customers. He believes that fruit growing is destined for a long time to be the best paying business in the arid region in spite of the low prices of the last season, when, indeed, it has paid better than any other branch of agriculture. Next to the winter apple comes the late peach, and prunes are still being planted in large quantities.

Among the interesting features of Mr. Whitney's grounds is the old mill once operated by Col. Sims, brother-in-law of General U. S. Grant. In the ante-railroad days this old mill was a great trading post. It is stated that two hundred mules were loaded here every day for the mines of the north country with bacon, flour and whiskey, for the thrifty colonel combined a distillery with his flouring mill, and fatted a great number of hogs on the refuse. There is also a great three-story packing house on the place, where the fine packing is done for which these nurseries are particularly noted, and which enables Mr. Whitney to guarantee the arrival of his shipments in good condition.

IRRIGATION OUTLOOK FOR ARIZONA.

Much activity is manifested in all lines of irrigation work. Nearly all the older companies are enlarging and extending their canals. Several new enterprises have been put in better shape, and are now expected to be pushed to completion. The Agua Fria Reservoir and Canal Company is working a large force. The Hudson Reservoir Company have interested New York capital and have resumed operations looking to the construction of works to store waters of the Salt River to irrigate a very large area. The reorganization of the Florence Canal Company and the Gila Bend Reservoir and Canal Company are both about consummated, and large improvements are planned for both systems. The Buckeye Canal Company of the Gila River have interested London capital with the purpose of extended improvements and enlargement. The Rio Verde Company have announced that work will begin on their $2,000,000 enterprise in January.

Work has commenced on the enlargment of the Maricopa Canal to twice its present capacity and will then follow to the Grand and Salt River Valley Canals, and as these companies have bought machinery together and have each a large surplus in their treasuries, work will be no doubt be pushed to an early completion. The Arizona Canal Company will soon put in a large dredge to enlarge the main canal. The Consolidated or Mesa Canal has just finished a new head, 60 feet wide, which makes a great improvement in their works.

No effort has been made to establish a state engineering department, but it is understood there will be at this session of the legislature.

The Carey law is believed, in Arizona, to be a very good thing which should be extended to benefit the Territories. Until that is done, of course, nothing can be done in the Territory. A strong effort will be made to secure congressional action favorable to Arizona. on this matter, that the ensuing session of the legislature may act upon it to create necessary commissions, etc., to make it available.

GILA BEND DAM.

The washout of the dam at the Gila Bend, Ariz., during the recent floods, has raised the very old question as to the proper recognition of the engineer in charge. It appears that a controversy arose between

the engineer in charge, Mr. H. Clay Kellogg, and the foreman, some time in May. At that time 1,500 feet of the east end was finished, and the piles were driven in what was termed the "new work at the west." They were filling in the foundations with rock and putting up the bents of the superstructure. The controversy was in reference to filling a space of thirty feet on the south side, where considerable water was passing under the lower sheet-pile line. The engineer insisted on stopping it; the foreman thought his plan unnecessary and too expensive. The consulting engineer upheld the foreman, and Mr. Kellogg was relieved. It was at that point where the washout occurred. He claims that but little of the eastern portion, which had been finished under his direction, was carried away, and that probably by abrasion. It is not the first time in the history of dam building that the foreman has assumed to know more than the engineer, nor is the first time that the management have economized very greatly to their disadvantage and subsequent loss. Such a disaster is in every respect unfortunate, not only involving heavy loss to the company, but calcutated to discourage other effort.

CALIFORNIA.

Those who eat the "forbidden fruit" from the Redlands orange orchards, have to submit to the county diet as a penalty.

At the agricultural experiment stations, a display of small signs is now made upon the grounds to indicate to passing farmers the subjects under investigation for the time being.

Many of the Southern California orchards will yield an average net profit this year of $300 an acre—in exceptional cases more.

Many parts of the State are overrun by vagrants, who are becoming a very great nuisance.

The San Joaquin Valley Railroad is at last receiving due attention from San Francisco capitalists. That city has subscribed more than $2,000,000; Oakland, $200,000, and Stockton, $100,000.

San Joaquin County has shipped oranges by the car load for the first time.

Abundance of rain all over the State gives assurance of good grain and hay crops.

Azusa, in the eastern part of Los Angeles County, is becoming noted for its strawberries.

The Vacaville *Reporter* says fully one-fifth of the entire fruit shipment from the State is from within fifteen miles from Vacaville. It suggests that an organization of the fruit growers there could have a pronounced influence on controlling the market.

A new fruit, casabana, has been introduced from Louisiana. It is of the banana family, but will stand a lower temperature.

A discussion is in progress in Southern California as to the injury suffered from heavy rains by the orange crop. There is a tendency to overgrown fruit, and where smut prevails it renders the fruit unsightly. Otherwise there appears to be no material injury.

At Redlands the orange crop is in prime condition, and growers are getting high prices for an unusually heavy crop.

The demand for California oranges is a month earlier than usual, due to the widespread destruction from frost in Florida.

Palermo orange growers are hard to satisfy. Not content with having a month of advantage in earliness, they are said to be using Redlands' brands to get credit for the latter's reputation.

R. S. Thompson, of Highlands, has been shipping 125 boxes a week of fine strawberries from his hillside farm, to Redlands.

Lytle Creek, in San Bernardino County, was diverted from its course during the floods, and it required prompt and energetic work to turn it back again in its bed to prevent serious damage.

The 700 acres of the Alessandro orange grove, which was frozen out a year ago, near Moreno, has been divided by lot among the shareholders.

An effort is being made to secure legislation that will exempt improvements on lands within irrigation districts organized under the Wright law.

The Redlands orange crop is estimated at 440 car loads for the year; less than one-fourth has been shipped.

The Editorial Association of Southern California held its annual session on the 4th of February, at Riverside. They were entertained by excursion to Perris, and to the recently completed irrigation works of the Hemet Company.

The Orange County Fruit Growers' Exchange opened the season with orders in hand for nineteen car loads, which were allotted to the different associations.

Alfalfa hay at $18 a ton in Santa Ana, and rising, indicates the scarcity of forage in that section.

Bonds for $300,000 to build a sugar factory at Anaheim, have been sold in the East at 90 cents on the dollar.

The Sunset Irrigation District, containing 300,000 acres of land in Fresno County, has failed to sell its $3,000,000 of bonds, issued four years ago. No works have been completed and no water put upon the land. The opponents to the district organization have finally carried an election, and it is probable that the district will be dissolved.

ARIZONA.

An ostrich farm in the Salt River Valley is a paying investment. There are forty-nine grown birds and one chick, all the produce, within a few years, of two birds imported from California. It has paid fourteen per cent.

The Phœnix *Gazette* says Arizona spends $3,000,000 annually for whiskey—$16 for corn juice to $1 for education.

J. V. Spainhower, of Mesa, harvested thirty to forty bushels of wheat to the acre, then thoroughly plowed and planted to corn, getting a fine crop, and this was followed by a heavy volunteer wheat crop, all in one season.

The Salt River Valley has proved its adaptability for orange culture during the present hard winter. Its oldest orchards are just beginning to bear paying crops.

And now the Phœnix papers complain at the high freight rates over the new railroad from the North. It seems to be the old story—all the traffic will bear.

The opening of the Phœnix and Prescott Railway, giving a connection with the Santa Fé system is good reason for jubilation on the part of the Salt River Valley people.

Prof. Boggs, of the University at Tucson, has a class in surveying, which he is giving practical in-

struction in the field. An excellent departure from the class-room routine.

Grain hay is being shipped from Phœnix to Los Angeles, Cal.

Herbert Brown, of the *Citizen*, has donated to the Arizona University a remarkable and very valuable collection of 1,200 birds and a great variety of eggs, illustrating the ornithology of the Territory.

COLORADO.

Boulder County farmers will contribute liberally of seed potatoes, raised by irrigation, to the drouth-stricken brethren of Western Nebraska.

Montrose fruit growers are considering a canning factory proposition.

Abundance of water for the canals in all parts of the State is assured for the coming season.

The city of Greeley positively interdicts the "living picture" performances.

The Union Pacific last season hauled 214 trains of deciduous fruits, 159 of oranges, and 8 European specials.

There is active rivalry among the ditch companies taking water out of the Arkansas. The time is close at hand when storage will have to be provided, or there will not be enough in the dry season to go around.

It is possible that the Colorado Legislature will provide by law for an artesian well experiment or two, on demand of the irrigators.

IDAHO.

The Weiser *Signal* favors the indorsement of irrigation district bonds by the State to secure the benefit of better credit and a lower rate of interest. With proper restrictions and supervision it might be permissible, but it would give opportunity for serious abuses without.

The Legislature has passed a joint memorial praying Congress to appropriate $125,000 for surveys in the State to assist in carrying out the provisions of the Carey bill.

NEW MEXICO.

A letter from Santa Fé says that it is not likely any material changes will be made in the irrigation laws this winter. The present law is working very satisfactorily. Two or three bills on the subject have been defeated. The snows are very heavy, and plenty of water is assured for the coming summer.

WASHINGTON.

The Spokane *Chronicle* insists that the public surveys should include at least a million acres in this State for the present year; that actual settlement is in advance of the surveyors.

The great Nez Perces Reservation is soon to be opened to settlers—an opportunity for home-seekers.

WYOMING.

The immigration boards have failed to meet expectations. The public interest has not been sufficiently aroused.

SOUTH DAKOTA.

C. K. Howard, on the Cheyenne river, has just finished three miles of ditch, has put in a 20-horse power engine and centrifugal pump to raise 2,200 gallons per minute 18 feet high. This is to irrigate from 300 to 400 acres of bottom land, to be planted to alfalfa as an adjunct to cattle ranching. He will use the alfalfa to give his calves continuous growth through the first winter.

NORTH DAKOTA.

Cattle are reported as doing well on the ranges.

Diversity of crops is a subject claiming the special attention of farmers this winter. Wheat is getting too low in price to depend on for an only crop.

TEXAS.

Irrigation from wells by windmill power is being practically introduced in many places. Some gardeners in Hale County have produced a large crop of celery by aid of windmill and pump, which will yield them a handsome profit.

E. H. LIBBY.

Mr. E. H. Libby, having ceased to be connected in any manner with THE IRRIGATION AGE, is now engaged in promoting irrigation enterprises, and also devoting considerable attention to colonization work with the expectation of being successful in the attempt to provide settlers for some land in Washington.

A NOVEL ORCHARD PLAN.

I. R. Beery and several associates at Payette, Idaho, are arranging to develop a large orchard property in the Payette Valley on lands in the neighborhood of the Plymouth Colony tract. They will plant this land to peaches, pears, apples and prunes, and sell stock in the Orchard Company. It will be conducted under the California method of irrigation and cultivation and it is hoped that the stockholders will realize good dividends as a result.

The conditions for the enterprise are most favorable. The soil, climate and water supply are the best, as the success of other orchards in the neighborhood amply demonstrate. Such a company in such a locality, with thoroughly competent management and a conservative basis of capitalization, ought to prove a good investment. There are great possibilities in this line of business, and it would seem as if they might be realized in the case of this enterprise. We would suggest that another good feature of the plan would be to make the stock good for the purchase of tracts of these fruit lands and improvements, so that investers who might desire to make their homes upon the lands at some time in the future would be able to do so without further investment. The outcome of this enterprise will be watched with great interest.

The *New York World* says: "Art Idols of the Paris Salon" is a quarterly publication begun by the White City Art Company, Chicago, which will number in all 100 plates, about 15x20 inches in size, reproducing the masterpieces of French art for 1894. The January number contains six plates. The reproduction is admirable in its mechanical execution, and the six plates are six gems.

POULTRY AND EGGS.

A very pretty little catalogue has been issued by the Le Grand poultry ranch of West Riverside, Cal., descriptive of their breed of single-comb White Leghorns. It is illustrated by many fine engravings of the fowls and their houses. This ranch makes a specialty of eggs for hatching, and has been very successful in building up a trade. The catalogue will be sent free on application.

A PRACTICAL FARM BOOK.

A great many books have been written on farm topics, but Prof. Thos. Shaw's new work on Grasses and Clovers, Field Roots, Forage and Fodder Crops seems to be the most valuable contribution that has yet appeared on these subjects. It tells what crops are best for certain soils and latitudes, how to prepare the ground for the seed, how to sow the seed, how to care for the crop, how to harvest and how to feed it. Some writers know a good deal, but cannot tell it; others write a good deal but do not know it. All who read this book must acknowledge that Prof. Shaw is thoroughly up to date on the questions he discusses, and he throws out some interesting suggestions to those who like to follow advanced thought in Agriculture. Prof. Shaw has carefully avoided that rock on which many authors have wrecked the usefulness of books that otherwise would prove highly valuable in that he avoids the use of technical and abstruse terms that serve to confound the reader. He makes his points in language so plain and direct that no one who reads can misunderstand, and it is a book that will be worth its weight in gold to those who seek practical information. Prof. Shaw's practical experience as a farmer, his long connection with the Ontario Agricultural College at Guelph and the Minnesota State Experimental Station, and his well-known abilities as a writer qualify him to write as few men can, and as no one else has done, on these topics.

This book is just out of press, and is given away by the Northrup, Braslan, Goodwin Co., Seedsmen of Minneapolis, Minn., as a premium for orders for vegetable seeds to the amount of $3.00, or for field or grass seeds to the amount of $6.00. Their catalogue, which will give further particulars and information, is mailed free to applicants mentioning this magazine.

The book consists of 150 pages, is printed on the best super-calendared paper, profusely illustrated handsomely bound in cloth, embossed in gold, and should be in the hands of every one engaged in agricultural pursuits.

A TIMELY BOOK.

At no time in the past twenty-five years has the public interest in our national financial policy been so eager, anxious and prophetic of a speedy and satisfactory final solution as at the present moment.

With the unscrupulous, relentless hand of greed pulling fretfully and persistently at the administration halter, and the basely ignoble spectacle of a practically invincible, indestructible national credit submitting to open debauchery, what truly American citizen can with complacent self-respect look confidently into a future already darkened by the treacherous designs of the heartless gold power?

As all epochs in history have produced their great men, so has the turbulent condition of financial uncertainty and apprehension evolved a loyal sentiment which the genius of a patriot has crystallized into a bright star of promise. "Coin's Financial School," the strongest, simplest and most surprising work on finance ever written, is leading us out of the wilderness. Its luminous central truth is undeniable, its statistical comparisons invaluable. It is a magnificent and irresistible appeal for justice. Its work of conversion and education is being enthusiastically applauded from coast to coast. We not only earnestly commend it, but urge every citizen of the great West togive it immediate and careful study and consideration.

GIVE THE FARMER FACTS.

The average planter has but little use for finely spun theory, whether it pertains to the relation of his condition to politics or whether it deals with the best ways and means of growing the best crops. What he wants is Facts. No one has realized this more than the great seed firm of D. M. Ferry & Co., Detroit, Mich., who for forty years have been studying the wants and condition of planters, large and small, and as a result have created the largest seed business in the whole world. Without doubt, a strict adherence to the policy of dealing in facts represents the secret of their success. They know their seeds are right before they are sent to the many thousand dealers from whom the planter gets them. The dealer knows this to be a fact, requiring no further question, and the planter finds it to be a substantial fact when harvest time comes. Another illustration of the value of this method is found in Ferry's Seed Annual, in which there is nothing but facts. Facts that prove of the greatest value to every planter; facts about how, when and where to plant, that can be had from no other source. There are no worthy facts left out, and no unworthy theories let in. This book is sent free to every one who asks for it. A postal card with your name and address sent the firm will bring it to you.



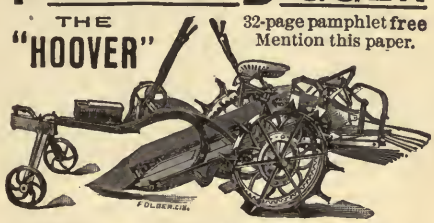
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CALIFORNIA HOMES.

THERE are more people who are expecting to purchase homes in California than in any four of the other Western States.

The scenery of the Rocky Mountain region is equal to that of California, but no other State possesses the genial climate of the Golden State.

There is almost as much difference between the climate of Northern and Southern California as between Northern California and some of the States farther East.

There is also a great difference in the social atmosphere in that part of California that was settled in '49, and the portion south of the Tehachipi Mountains, the population of which has largely been built up since the advent of the Santa Fé Railroad, about ten years ago. Mining attracts a speculative and an adventurous class of people, while fruit growing and farming is more inviting to those in search of a quiet and domestic life. In fact, the people in the rural communities in most of the States, except where the foreign element predominates, are as a rule of temperate habits. The remarkable increase in the number of school houses and churches in Southern California during the last ten years has scarcely been equaled in any other part of the United States.

The reader unfamiliar with the climate of the various parts of California can easily see by taking a good map of the State that the Coast Range of mountains, which shuts off the sea breeze from the Sacramento and San Joaquin valleys, takes an easterly trend when about 300 miles south of San Francisco, thus leaving what is known as "Southern California," on the coast side of the mountains. This accounts for the delightful summer climate in this part of the State, which is perhaps more appreciated by the residents of Southern California than even the winter months with their flowers and sunshine.

Very few, if any, persons who have farmed in an irrigated country, which has a sufficient water supply, would prefer owning land where he must depend on chance of rain for moisture, coming more often at the wrong time than the right time, yet every one knows the great importance of having an ample supply of water. The writer is quite familiar with every Southern California colony, and therefore does not hesitate to state that no choice fruit land, with an ample water supply and suitable climate for fruit growing, can be purchased for less than $250 per acre in the famous San Bernardino Valley, anywhere between Redlands and Los Angeles. The lands now being sold by the Hemet Land and Water Company at $125 per acre are equal in soil and water supply to any land in the State.



A VIEW OF THE FLUME LINE OF THE HEMET LAND COMPANY.

Before purchasing land anywhere in the arid region, inquire of the bankers or the best civil engineers in Southern California concerning the water supply at Hemet, and the reliability of the owners of this land to fulfill their promises.

If you are not familiar with the irrigation idea, permit us to state that there is a great deal of land for a small supply of water in Southern California, so you should make sure of the water supply first, and then you will find no trouble in finding plenty of land to put with it afterward.

There is but a small area of land for sale that has the right to this water supply, and the prices are low For full information write to M. P. Borden & Co., 528 Stock Exchange Building, Chicago.

THE IRRIGATION AGE.

VOL. VIII. CHICAGO, APRIL, 1895. No. 4.

THE PROGRESS OF WESTERN AMERICA.

And Still the Tide is Rising. The conquest of public sentiment in behalf of the plans of the irrigation propaganda goes bravely on. Some of the larger developments of the past month occurred too late to admit of a full report in this number of THE IRRIGATION AGE, but events are moving swiftly, and when the Irrigation Congress is again assembled in September the National Committee will be able to report more progress for the past few months than for the entire period of its previous existence. One of the most satisfactory strides of the month was the publication in *The New York World* of Sunday, March 3, of a four-column illustrated article by the chairman of the National Committee. The importance of this event lies in the fact that *The World* is the most widely read of all American newspapers, its Sunday edition, especially, covering the continent with its comprehensive circulation. Furthermore, it has generally happened that movements receiving the conspicuous attention of *The New York World* have also quickly commanded the appreciative notice of the press throughout the United States. *The World's* article has already developed wide and favorable newspaper notice, and led to voluminous correspondence from all sorts and conditions of men. This furnishes additional evidence of the fact that the time for a great advance is thoroughly ripe. To conquer and occupy the Western empire, utilizing surplus labor and capital, is the best solution of present difficulties and future dangers. The American people are beginning to see the matter in this light. We ought to prepare ourselves for a mighty movement, because when the tide really starts it will be very broad and deep, like the colonization movements of the past.

Before a Boston Club. The friends of irrigation in the West will be interested in following the experience of the chairman of the National Committee in presenting the Western idea to various intellectual elements of the East, and they will be especially interested to know just how the idea is received in the populous and wealthy parts of the country. On the afternoon of Saturday, March 9, the writer was the guest of the Twentieth Century Club of Boston, at its old-fashioned home in Ashburton Place. This club is composed of advanced thinkers among the highest professions. It includes many journalists, lawyers and college professors, and the very name under which these men assemble indicates that they offer fertile soil for new ideas and movements. The guest felt at perfect liberty, in such a presence, to clothe his views in vigorous and even audacious speech. He therefore arraigned the Eastern provincialism which knows and cares nothing about the vast empire in which national destiny is to be outwrought, while it listens with wide-mouthed interest to the latest traveler from Darkest Africa, and strains the eye to catch the earliest glimpse of the returning adventurer from the North Pole. The statement that "if the Pilgrim Fathers had landed at San Diego, instead of at Plymouth, we could hardly have hoped to settle New England with a desirable class of people," was received with a demonstration that endangered the roof. So also was the remark that irrigation is not a substitute for rain, but rain a very poor and inadequate substitute for irrigation. The speaker found these advanced thinkers of Boston really very responsive to the call for the revival of the national spirit of continental conquest, and deeply interested in the proposition to move population into the West and develop institutions of such an industrial and social character as to contribute to their happiness and prosperity. The speech was followed by a flood of questions, mostly directed to these points; (1) Will the people be willing to leave the cities and towns? (2) Can capital be furnished a really sound security for the necessary advances? (3) Can such a movement be organized and sustained in a purely public spirit, rather than in the interest of land companies? The applause with which the answers to these questions were received, as well as the hearty expressions of sympathy and support tendered

on every hand, at the conclusion of the meeting, encouraged the guest to believe that there would be no fatal doubt on any of these heads.

Facing the Real Bostonese. On the day after the meeting at the Twentieth Century Club, the chairman of the National Committee addressed an audience at the Parker Memorial Building, and there the impression seemed to be wholly favorable. Much talk ensued, but the tenor of it was entirely friendly and sympathetic. It was not until the meeting at the South Congregational Church, out on the Back Bay, that the representative of the new movement came face to face with what may be termed "the real Bostonese." This meeting was held Tuesday afternoon, March 12. It was attended by delegates from various organizations which stand for the intellectual life of Boston and its environs. There were philosophers, sociologists, political economists. divinity students, and last, but far, far from least, the typical Boston woman, of earnest but kindly countenance, whose bright eyes gleamed through glasses. And this was the occasion when the Western Idea had to fight for its life. The young men from the classic shades of Harvard said they had been taught that workingmen are divided into three classes as follows: Those who will work, and all of these now have jobs; those who can't work, and their disabilities would not be removed by residence in the West; those who won't work, and they would be as incorrigible in one place as in another. This being true—and, since it was learned at Harvard, it *must* be true—what is the use of talking about helping people by finding labor and homes for them in Western America? The divinity students were convinced that there is no trouble with our economic conditions, but only with the moral atmosphere of the times. Perhaps crowding in cities *is* responsible for this, but to transfer men to the irreligious and God-forsaken West, which is one dreary waste of barrooms and gambling hells, would be infinitely worse. Now, if it is well to put the surplus people of the cities on the land, why not do so in New England, where there is an abundance of unoccupied land [lately vacated by those who could not make a living on it.—Ed.] But it remained for the real Boston woman to bring forward the unanswerable arguments. She said, "If your movement succeeds, it will divert to the West all the young men, and leave the surplus women of Massachusetts even worse off than now." When the people laughed, she impatiently protested, and said, "Don't laugh, It is no laughing matter. The science of sociology teaches us that this is most serious." But that was not the hardest shot. She said afterward: "There is something in the air of the West that breeds financial lunacy. People who are sane enough in New England go out West and become raving maniacs on the subject of free silver. They ruin themselves and bring down all the rest of us with them. Do we want to send out our people to have them turn and rend us? I think we will struggle along with our problems at home." *The Boston Herald's* account of the meeting says: "The program was subjected to a somewhat searching analysis, but Mr. Smythe had his lesson well learned."

A Triumph in Idaho. While the National Committee has been pushing the agitation in the East, by means of pamphlets, newspaper articles and public meetings, its members have also been alert and aggressive in the West. It looks now as if 1895 would be a very great year for the cause of irrigation, on both sides of the continent. The favorable action of the Wyoming Legislature was noted in these pages last month. We deeply regret to be obliged to record the failure of the effort to utilize the Carey Law in Oregon. No blame attaches to Chairman Brigham and his associates of the State Commission. They fought hard and well, and were unexpectedly defeated at the last moment. In Idaho a triumph of the most marked kind was achieved in the face of the hardest conditions. Idaho, like most of our Western States, has been strangely indifferent in the matter of irrigation legislation. Her opportunities in connection with the Carey Law are extraordinary, and the friends of the cause early determined to make the strongest possible effort to obtain wise supplementary legislation. But they encountered disappointment at the start. To their very great astonishment, the Governor made no mention of the matter in his inaugural address. Then the member of the National Committee elected at Denver advised the chairman that he could not organize a State Commission, that he could not give the matter the attention it required, and that opposition and indifference were such that no results this year could be expected. He tendered his resignation, which was accepted, and Douglas W. Ross, of Payette, appointed in his place. It was very late in the day to attempt to organize the forces for victory when Mr. Ross was named. There was no money available for railroad fares, hotel bills, telegraph or postage. But the new member repaired to Boise and entered with rare courage into the unequal fight. He not only fought for a law, but for a *good* law. He scornfully rejected offers of help on the basis of legislation which should sacrifice the great principle of public ownership of works when their cost has been returned by full payment for water rights. The battle lasted up to the hour when the Legislature adjourned. But victory came after all, and the chairman of the National Committee was inexpressibly cheered by the receipt, while in conference with the leading citizens of Boston, of the following telegram:



DOUGLAS W. ROSS.
Member of the National Executive Committee for Idaho.

"BOISE, Idaho, March 9.
"Idaho offers one million acres for colonization. Satisfactory bill signed by the Governor.
(Signed.) "DOUGLAS W. ROSS,
"Member for Idaho."

Ten years hence the people of Idaho will realize, as they cannot do to-day, the debt of gratitude they owe Mr. Ross for his gallant fight. Idaho is, of course, indebted to many others, chief among whom are Governor McConnell and leading members of the Legislature, but Mr. Ross was the official representative of the organized irrigation sentiment, and upon him devolved the responsibility of obtaining legislation at this critical and opportune time. He has splendidly vindicated the faith of his friends.

Montana Joins the Procession. Montana is another State where a very hard fight was forced upon the friends of irrigation, not merely by the indifference of the public, but by the active opposition of certain elements. Here, too, noble public service was rendered by the State's member of the National Committee, who in this case was S. B. Robbins, of Great Falls. This gentleman was also obliged to make the fight at his own expense, and he spent money and time unstintingly for this cause. As the end of the session drew near, and one obstacle after another was encountered, it was felt that the splendid effort would end in failure. But it did not. The following telegram to the chairman of the Committee, also received in Boston, told the story of final victory:

"GREAT FALLS, Mont., March 14.
"Montana Legislature passed bill providing for reclamation of land under Carey Law. Great Falls alone needs thousands of farms, each supplying thousands of dollars of produce annually for home market. Hundreds more can market wheat and barley for cash at mills and breweries in operation, or now building. (Signed.) S. B. ROBBINS,
"Member for Montana."

Nevada Wide Awake at Last. The people of Nevada also propose to have some share in the prosperity and progress of the new era of irrigation. Nevada was most fortunate in electing a governor who appreciates the full importance of the issue, and who has the laudable ambition to make his administration memorable for its record of achievement in the matter of conquering and occupying the soil. Governor Jones was the Nevada member of the National Committee in 1893–'94. His report to the Denver Congress was reviewed in THE IRRIGATION AGE for October. It will be remembered that he claims that an enormous acreage of good land—running into the millions of acres—can be watered from available streams and storage sites. No State in the Union has so strong a motive for desiring to realize large benefits from the present movement as Nevada. A State of most extraordinary resources, it has become the football of every critic of the West because of its dwindling population. Daniel Webster said of Dartmouth College: "It is indeed a small college, but there are those who love it." So may the public-spirited men of the Battle-Born Commonwealth say that there are those who believe in its stupendous capabilities for the support of a prosperous population, and who are determined that its day of splendid development shall begin now. The work has been well begun. Two measures, one providing for the acceptance of the Carey grant, and the other providing a good code of water laws with an administrative system, were early introduced, and it was expected that both would pass. At the last moment both failed, which is very unfortunate for Nevada. If they had carried, the present year, in our judgment, would have seen the State started upon a live policy of development. It is possible that something can be done, even now, with the school lands. Much credit is due Committeeman L. H. Taylor for the vigorous effort he put forth to give Nevada the fullest benefit of her opportunity.

Washington Accepts Her Opportunity. Washington is the fourth State to accept the grant of 1,000,000 acres. There, as elsewhere, a strong effort was required. Dr. Blalock, of the National Committee, fought and won the battle. The following telegram

was received, like the others, in time to be submitted to the Boston mass-meeting:

"WALLA WALLA, WASH., March 18, 1895.

"Washington will welcome homeseekers with outstretched arms. Carey law utilized. Homes for half a million people can be offered on irrigable lands of Washington, where fruit trees are now in bloom, and gardens and wheat fields are green. Lowest temperature of past winter 11 above zero.

(Signed) "N. G. BLALOCK,
"Member for Washington."

Character of the New State Laws. The struggle for and against the utilization of the Carey law brought out a variety of bills in the different States, and at this writing we have not at hand the full text of the measures as they were finally passed. We cannot, therefore, analyze them fully at this time. We know, however, that Idaho and Montana have gained the supreme advantage of providing State engineers, and that the effort has generally been to follow the lead of Wyoming. By the way, we are advised that our comment of last month on the powers conferred upon the State engineer in Wyoming was based upon the original draft of the bill, and that the measure as enacted makes this official merely the consulting engineer of the Board of Public Lands. We shall take early occasion to compare and discuss the measures which have been passed in Wyoming, Idaho, Montana and Washington, and which have opened to settlement, under the new law, 4,000,000 acres in those States.

A Roll of Honor. The day will sometime come when not only the Western people, but the broader American public, will realize how well they have been served by the unpaid, tireless and undefeatable group of men who compose the National Executive Committee of the Irrigation Congress. These men have given generously of time, money and effort to carry forward the common cause of the West in face of indifference and opposition. The following have devoted a hard winter's fight to render the Carey Law effective in their States:

ELWOOD MEAD, Wyoming.
DOUGLAS W. ROSS, Idaho.
S. B. ROBBINS, Montana.
N. G. BLALOCK, Washington.
L. H. TAYLOR, Nevada.
F. H. BRIGHAM, Oregon.

Four of them have succeeded, and their States are to-day facing, in consequence, the greatest opportunity of their existence. To this roll may be added the names of J. W. Gregory and I. A. Fort, who, in



ACRES OF CARNATIONS.
Through Courtesy of "The Land of Sunshine."



S. B. ROBBINS.
Member of the National Executive Committee for Montana.

Kansas and Nebraska respectively, have made strenuous efforts for good irrigation laws. Judge L. F. Shurtliff, member for Utah, has also done splendid service in the way of organizing a favorable public sentiment, and in protecting the interests of irrigation before the constitutional convention of the embryo State. He has been most ably assisted by C. L. Stevenson, of Salt Lake. In California, Secretary Alles has been as indefatigable as ever in his attention to the work of his office, and ex-Governor Sheldon, the State member, has done all in his power to accomplish results in face of adverse circumstances. Professor Boggs, in Arizona, has his work still before him, as the Carey law does not yet apply to the Territories. Max Frost, member from New Mexico, has cut out for him a big job in preparation for the Fourth Congress, to be held in Albuquerque. In Texas and Oklahoma, General Clarke and Judge Pitzer have served the cause by calling conventions and organizing vigorous local movements. Mr. Kellogg contended unsuccessfully against odds in Colorado. This year's committee, as a whole, marks a distinct advance on any previous body in the matter of intelligent activity. It is the ambition of the committee to show a magnificent record for the year when it reports to its constituents at Albuquerque.

The Next Irrigation Congress.

There were those who predicted that there would not be another session of the Irrigation Congress. Such prophets reckon without knowledge of the forces that move and direct currents of human thought and action. The Fourth National Irrigation Congress will be held late in September, at Albuquerque, New Mexico. It will be the largest and livest, the most interesting and most useful event of the kind yet held. It will attract far more notice throughout the country than did the meeting at Denver last year, as that commanded more attention than the meeting at Los Angeles, and as the Los Angeles event attracted more attention than its predecessor at Salt Lake. Movements of such significance to the Nation and the race as the irrigation movement, do not grow smaller and weaker while their work is still before them. They grow greater and stronger. Already the plans of the next congress are well in hand. The National Committee is busy with its program of commission reports, papers and addresses, which will be more comprehensive than ever before. The local committees are dealing enthusiastically with the details of their preparations for entertainment and sight-showing. The New Mexico Legislature appropriated $2,500 as a contribution to the expense of the Congress—an instance of unparalleled generosity in such matters. Meantime, the phenomenal development of interest in the reclamation and settlement of the arid region, exhibited both in the West and in the



L. H. TAYLOR.
Member of the National Executive Committee for Nevada.

East, will lend to the coming Congress an importance and a power of attraction which no previous event has enjoyed. It may be predicted that New Mexico, Arizona, Kansas and Oklahoma will send large delegations; that Colorado, Nebraska, Wyoming and Utah will send very fair delegations; that California, Nevada, Washington, Oregon, Idaho, Montana and the Dakotas will send representative delegations; that there will be scattering delegations from all over the Union, as well as a good many spectators, newspaper correspondents and homeseekers.

The Lesson of the Crow Indians. The article, in this number, on the work being done by the Crow Indians in Montana, in building canals and irrigating land, is rather timely from the standpoint of the movement now being organized in the East in the interest of the unemployed. We presume nobody will contend that the idle labor of the great cities is inferior to the Indian character in point of intelligence, physical stamina or desire to be self-supporting. If the Indian can be induced to build canals and create farms upon the arid public lands, it would seem as if white men could be utilized to the same purpose and in a much higher degree. It is only fair to say that the chief interest in our movement which has been aroused in the East is in connection with finding labor and homes for the unemployed, and that upon this question there is very great skepticism, strangely blended with a very great degree of interest and a general disposition to give the idea a chance. Our prediction is, that very much the larger per cent. of colonists who shall be attracted to Arid America in the next ten years will come from the ranks of the middle classes, and possess sufficient capital of their own to start homes. But the problem of the unemployed is just now very pressing, and this fact has been utilized to bring irrigation before the public in the East. We do not believe it is possible to successfully contradict the proposition that what the Crow Indian is doing the homeless Bedouins of the city streets can do, under wise and vigorous superintendence.

A Conference of Western Men. The campaign in the East, to which the chairman of the National Committee has devoted his time almost continuously since December last, has now reached a point where a conference of Western men is imperatively demanded. It is proposed to call such a conference at Denver during April or early in May, and to invite members of the National Committee and State Commissions, together with other prominent public men. The matters to be considered include the following: First. Plans for perfecting a means of co-operation between States that have accepted the Carey law and prominent Eastern men who are ready to assist in making colonies for the unemployed. Second. Organization of a Western editorial league to supply literature for the colonial clubs. Third. Project for a combined exhibit of irrigation resources, methods and products in New York and other Eastern cities. Fourth. Program for the Fourth National Irrigation Congress at Albuquerque, in September. Fifth. Program for the First Southern Irrigation Congress at Atlanta, in October. Sixth. Project for a tour of inspection of the valleys of Arid America by eminent Eastern men, as a means of converting them to the championship of reclamation and settlement as a National policy. The Denver conference will have a most



THE LONE SENTINEL.

important bearing on the future of the movement in all its broadest aspects, and it should attract a large and representative attendance from several States.

Will Irrigators Lend a Hand? We direct especial attention to the brief article published elsewhere in these pages entitled "Demonstration Farms for Arid America." It is within the power of intelligent irrigators to furnish every State and Territory of the arid region, within the next six months, a living and unanswerable argument of the eternal truths of the irrigation philosophy. The battle now is for the small farm unit and individual independence by the production of what every family consumes. In these two principles reside the hope of a new civilization composed of free men who shall be beyond the reach

of want—of a civilization which offers the priceless social advantages of neighborhood association. The friends of the cause are putting these claims boldly forward, and are appealing successfully to the national imagination. But there is one argument which only the practical irrigators can supply, and this is the *argument of facts*. Organize Independence Leagues; create Demonstration Farms; show what a family can do in your locality with a small farm under a system of intense cultivation! Do these things, and next autumn your result will plead louder for your home, for Arid America, for the wonderful resourcess of the American people, than all the newspapers, magazines, books and lectures can possibly do. April is the time to begin.

Col. Hall's Remarkable Papers. We hope the papers by Col. Wm. Ham. Hall, of San Francisco, on "Irrigation Principles," which have been a leading feature of THE AGE the past winter, have received the thoughtful study they merit. We have no hesitancy in pronouncing them the greatest contribution yet made to the literature of irrigation economics by an American author. This is perhaps high praise, but it is deserved, and we may add that probably no other man among all the cultured minds that the irrigation industry has attracted to its service would have been able to put forth at this time a discussion of fundamental principles so strong, lucid, and impregnable. Col. Hall is a well-known engineer, but he was educated to be a lawyer, while natural taste and bent have given him the historian's love of research and analysis. He has brought to the preparation of these papers the varied qualities of the engineer, lawyer and historian. And they could not have been successfully written in the absence of any of these peculiar qualifications. Only the historian would have delved in the archives of the dead centuries for the Roman and Moorish theories and practice of irrigation; only the lawyer would have seized upon and separated the real significance of the civil code and common law as affecting our problems; only the engineer would have been able to apply the lessons thus absorbed to the peculiar physical conditions of Western America. At some convenient time we propose to review these papers more fully, and to trace the relation of their main principles to localities and actual problems. But we desire now to call attention to the chief point which has been clearly developed, and to apply it to the operation of the Carey law in the several States which have accepted the trust of one million acres.

Private Enterprise on Pubic Lands. With the exception of Spanish grants—inconsiderable when compared with the total area of our arid domain—all the millions of acres thus far reclaimed have come to their present owners from the Federal government, either directly through the Land Office, or indirectly through land grants to railroads. In all this work three general rules prevailed: First, that the land should be reclaimed as cheaply as possible; second, that it should be sold as high as possible; third, that there should be the least possible interference in the way of public regulation or control. Every influence worth considering has in the past favored the operation of these three rules. The enactment of the Carey law, together with supplementary State legislation, brings us to a new era in irrigation development. Let us illustrate by reference to Wyoming, which occupies, by common consent, the place of leadership in the matter of applying the Carey law. It will no longer be possible to build canals "as cheaply as possible." They must be built with due regard to



A COLORADO SCENE.

the service required of them. They must meet the reasonable demands of the State as to size and character of work. It is the business of the State to see that these requirements are fulfilled, even if the cost of the canal be largely increased over the estimate of

the engineers or promoters. Neither can these public lands be "sold for the highest possible price." The State fixes the maximum price at which land and water rights may be sold, and it is the State, rather than the individual or company, that will be held accountable by the people if the price at which the lands are offered is out of proportion to the cost of reclamation. Neither can water be appropriated, canals built, or works operated "with the least possible interference in the way of public regulation or control." Everything will be done with such regulation and control. And the principles applied under the Carey law mark the beginning of the end of the era of reckless enterprise, based on unrestricted gobbling of the public waters and wild speculation in public assets. Now, Col. Hall's discussion of irrigation principles, not only clearly proves that what has happened in Wyoming was the inevitable outcome of the industry in all countries and all ages, but it also proves that water can never be recognized as private property, and hence that no enterprise can permanently exist on the basis of a system of water rentals. We are rapidly coming to a time when public supervision and regulation will be rigid; when works will be built only for sale to landowners; when administration will finally rest with the people of well-defined hydrographic districts. In all this investment will be benefited, because it will rest on better knowledge, because it will be secured by more substantial assets, and — most of all — because upon these terms industrious men will occupy the lands under conditions which will enable them to repay the original investment, with reasonable profits.

Mass Meetings in Boston and Chicago. Just as this issue of THE IRRIGATION AGE goes to press (March 25), the first of the series of mass-meetings, in the interest of the irrigation propaganda, is being held in Boston, at Wells Memorial Hall. The call was headed by Edward Everett Hale and Edwin D. Mead, and numerously signed by other prominent citizens, including several labor leaders. The first of the colonial clubs was organized. Many influential associations and prominent gentlemen have signified their intention to coöperate in holding mass meetings in Chicago, and the first meeting will probably be called in Central Music Hall very shortly. Full accounts of these mass meetings, which signalize the rise of the irrigation idea to national prominence, will be presented next month in these pages.

Four Years of "The Irrigation Age." With this number THE IRRIGATION AGE enters upon its fifth year of existence. Its past four years are not so much the record of a magazine as the history of a cause. The publication was born of zeal for a cause; it has survived only by reason of its having been the instrument of a cause; it has accomplished nothing except to fight, and bleed, and all but die, for a cause. And whatever trophies it has won are in a peculiar sense the trophies of irrigation rather than of THE AGE as a publication. The magazine has gone through a long and varied list of vicissitudes. It has breasted many crises, and lived through many a "fatal" disease. It has seen many a day when, if business men had been trying to publish it for purely business purposes, the key would have been turned for the last time in its office door, since it would have been far more profitable to stop than to publish it. And yet it has lived through panics and failures and misfortunes, always with an array of good and loyal friends. It is not for us to say what part THE AGE has had in raising its cause from the sordid plane of ditches and acres to the dignity of a great national and human interest—in arousing and organizing public sentiment—in creating and disseminating a literature and a creed for industry, society and ethics in a new empire. But we can say, as General Butler said to the critics of his war record, that "when my country was assailed I buckled on my sword and did the best I could." We have worked hard, we have done our best. And we have had a pretty tough struggle in the midst of it all. There is one remarkable fact worthy to be recorded. THE IRRIGATION AGE has never wavered for an instant in expressing its convictions touching the iniquity of the Desert Land Law, the denial of private ownership in water, the need of rigid supervision and control of private enterprise by public authority, and kindred subjects which involve the rights of the people on one hand, and the selfish interests of corporations on the other. And yet it has never consciously lost business at the hands of private companies on that account, and never been threatened with their displeasure. It would not have deflected our course by a hair's breadth if the case had been different, but we gladly put on record this item from our four years' experience as testimony to the high-minded character of the men who manage water and land companies in the West.



DEMONSTRATION FARMS IN THE ARID REGION.

IT is within the power of the practical irrigators of our Western States and Territories to furnish the one conclusive argument which is required to convince the American people of the capabilities of the arid region for the support of a population on a prosperous basis. To do this is a duty which they owe to themselves and to their own local communities, not less than to the West and to the country.

Those who have not seen the arid region, and those who have seen it only from the car window, regard it as little better than a hopeless waste. When they are confronted with the successful experience of a community, here and there, they generally choose to regard it as an isolated instance which proves nothing as to Western America as a whole. The perverseness of popular opinion on this point is a stern fact, with which the champions of irrigation progress are constantly contending in the benighted East. Progress is being made in the work of converting the people in spite of this obstacle, but such a living argument as our irrigators might furnish, in at least a dozen States and Territories, would accomplish more for the cause in one year than all the magazines, books and speeches can do in ten years.

SMALL FARMS AND INDEPENDENCE.

The thing that we are trying to prove to the American people is this: That there are hundreds of valleys in Arid America susceptible of irrigation from waters readily available, where families of average industry and intelligence may win a generous living, by producing what they consume, on farms ranging from twenty to forty acres. In making this claim we are confronted by the statement that men who are now farming 1,000 acres in wheat are getting poorer each year, while in other parts of the West settlers who have recently gone into the country are calling upon the public to be saved from starvation. Both of these statements are grim realities, but they merely prove the truth of what is claimed for the small, irrigated farm. Men are starving to death in the semi-arid region not because they irrigate, but because they do not; the wheat-farmer is getting poorer because he has a big farm instead of a little one, and because he raises almost nothing except one staple product, and raises that in competition with the servile labor of Egypt and India, instead of diversifying his products to meet the needs of his family's consumption. These facts are perfectly plain, too, but the great American public sees only the price of wheat in one place, and the starving farmers in the other, and is just a trifle incredulous about the perfectly truthful and logical explanation that is offered by the friends of the small, irrigated farm.

FORM "INDEPENDENCE LEAGUES."

In every valley of Arid America where irrigation and settlement have made a beginning, there should be formed this spring an Independence League. Its object should be to demonstrate, within the next six months, that in each of these valleys a small farm, when well irrigated and intensively cultivated, will produce the variety of products necessary to the generous support of a family, with the exception of tea, coffee and the spices. Wherever this can be done the people have the raw material of industrial independence. Millions of good people in Eastern States and foreign countries are hungry for a chance to convert this raw material into the manufactured article known as civilization.

WHAT "INDEPENDENCE LEAGUES" CAN DO.

The Independence Leagues can each create a demonstration farm, which will forever prove the case for the particular valley or district in which it is located. We suggest that wherever this article is read and approved, leading citizens call the people together and form an organization. Let them rent or borrow a tract of irrigated land as near the town as possible, and of such size as they think best for a representative farm unit. In Southern California and Southern Arizona it might well be ten acres; in the intermountain country twenty acres would be better; and in Northern latitudes, like Montana, or high altitudes, like Wyoming or Nevada, forty acres, would be more fairly representative. This small farm should be at once brought into cultivation at the hands of a first-class man, and made to produce the greatest possible variety of garden and field crops, together with meat and dairy products. Of course, orchard fruits cannot be brought to maturity, but from the older places in the neighborhood the horticultural possibilities may be abundantly proven.

RESULTS OF THE DEMONSTRATION FARMS.

Wherever this plan is adopted the people will be able to prove next fall just what can be done with a small farm under a system of diversified industry. They will have a wonderful exhibit of actual results. A few years ago we all talked about the wonderful profits per acre that could be realized from this and that thing. That day is passed, we hope, forever. A period of hard times has taken the nonsense out of the public, East as well as West. Everybody now understands that it is a physical necessity to get a living first and get rich afterward. The destiny of Arid America is to furnish a field where millions can live, and live well; where they can live well in spite of hard times, droughts and panics; where they can work for themselves instead of for an employer who crystallizes their labor, except so much as buys a bare subsistence, into factories, fine dwellings and bank stock.

The demonstration farms will be worth more than the county fairs to the various localities where they exist. They will be talked about and written about everywhere, and will carry the fame of these valleys to the ends of the earth. They will be described in the literature of the Colonial Clubs, and become the text of many a sermon in the future.

WHERE DEMONSTRATION FARMS SHOULD BE LOCATED.

The demonstration farms should be scattered all over the Western half of the Continent to fully prove the case. We would suggest the following points as especially desirable:

In Western Kansas—say, Garden City.

In Western Nebraska—say, near Belmont.

In the Arkansas valley of Colorado, at Rocky Ford and Lamar.

In the San Luis valley of Colorado.

On the western slope of Colorado, near Grand Junction.

At some representative point at Wyoming.

In the Bear River valley of Utah.

At some point in Nevada on the Central Pacific Railroad.

In the Boise valley of Idaho.

Near Pendleton, Oregon.

At Walla Walla and Yakima, Washington.

At Missoula, Great Falls and Billings, in Montana.

At Bakersfield, Modesto and Hemet, in California.

At Phœnix and Tucson, in Arizona.

At Eddy and Las Cruces, in New Mexico.

We would be glad to see Independence Leagues and Demonstration Farms in many more places than are here suggested, but if the people of the localities named will take up the idea this spring, and carry it through to completion by next autumn, a tremendous gain will be made for the irrigation cause.

THE IRRIGATION AGE invites correspondence in relation to this matter, and will gladly publish all details of progress. It will do everything in its power to give communities the greatest possible advantage in the way of making known the results achieved by demonstration farms. We know the importance of this thing, and, with whatever influence we may possess, we urge the friends of irrigation to take up the matter, and to prove, beyond all possible dispute, that industrious families can live well on small farms, with all the social advantages that means, in their neighborhood. The demonstration farms can, of course, be made to more than repay their cost in direct returns from the soil, to say nothing of the value of the object-lesson and the advertising it will necessarily carry with it.



THE FIRST LESSON IN CANAL BUILDING ON THE CROW AGENCY, UNDER THE INSTRUCTION OF WALTER H. GRAVES.*

IRRIGATION WORK OF THE CROW INDIANS.

IS IT possible to utilize the energies and industry of unprosperous masses in Eastern cities and towns in the work of building canals and creating farms on the public lands? Will it then be possible to show them how they can become independent and self-supporting citizens? The first of these things is to-day in process of successful accomplishment by the Crow Indians in Montana. Those who know most about the matter believe that the second thing—the transformation of these poor red men into successful tillers of the soil—will also be accomplished.

It is probably not necessary to argue, even with a Harvard professor, that the white workingmen of the East are at least as intelligent as the red loafers of the West. Physically and intellectually the white laborer is at least the equal of the Crow Indian. It may be true that the Indian is better fed, and there may be those who would claim that he has been reared in more luxury. But certainly there is no reason to doubt that the success of the experiment on the Crow Reservation will carry a very strong argument as to the feasibility of teaching unemployed men to become landowners and farmers.

*The Indian at work is Chief "Spotted Horse." He is now one of the best workers. Spotted Horse was the only Crow Chief who favored the recent cession of 2,000,000 acres of the Crow Reservation to the Government, and he carried the question of the cession to a favorable issue against the combined influence of the other chiefs. He favors the idea of Indians working their way to civilization and earning their own living, rather than having annuities, provisions, clothing, etc., bestowed upon them by the Government. He says if the Indians can be furnished work and honestly paid for it and fairly treated they can take care of themselves.

THE CROW COUNTRY.

The Crow Reservation is about the size of the State of Connecticut, and will probably support fully as many people at some time in the future. The government purchased 1,800,000 acres on the west side of the reservation, and there was still left to the Indians a little principality of 2,913,960 acres. The Crow country has a varied landscape. There are undulated plains, areas of mesa and valley, pine-covered ridges, grass-covered hills, with rivers and small streams, fringed with a luxuriant growth of native grasses. The surrounding mountains form a picturesque background. There is also considerable broken land. The reservation flanks the outer ranges of the Rocky Mountain system, where it begins to blend into the great plains region. The altitude ranges from 2,700 feet along the lower valleys to 8,500 feet at the crests of the Big Horn mountains, and perhaps 3,500 feet is the average altitude. The soil in the valleys is generally good, and the climate is described as "between cold and temperate."

THE RIVER SYSTEM.

The Big Horn is the important river of the Crow territory. Rising far to the south in the heart of the Rockies, it drains an immense territory in Western Wyoming. It becomes a tributary of the Yellowstone in Montana. The discharge of the river was found to range from 2,263 to 5,700 cubic feet per second. The Big Horn river enters the reservation through a narrow gorge from 1,000 to 2,000 feet in depth and sixty miles in length. The river debouches from this canyon at a point twenty miles north of the Montana line into the largest and most important valley of the reservation. On the east side the line of the foothills follows the general course of the river, three or four miles from it, and rising abruptly from the surface of the valley, they distinctly mark its outlines. The valley on this side extends down the river for some thirty miles or more, and its surface is rather smooth and unbroken, except occasionally where cut by washes and streams in the hilly part to the east. Within this strip of valley there are from 40,000 to 60,000 acres, about three-fourths of which is suitable for irrigation. The total number of acres of irrigable land in the Big Horn valley is 80,000.

THE SEAT OF THE AGENCY.

The valley of the Little Big Horn lies just west of the Big Horn valley, and opens into it about midway between the mountains and the Yellowstone River. These two valleys together furnish all of the territory of the irrigable lands and water supplies that the Indians can ever possibly need. The agency, with its churches, school buildings, store houses and other improvements, is located in the Little Big Horn valley. In this respect it is the central point of the reservation. The Little Big Horn river has its source in the mountains, also in northern Wyoming, but so near the Montana line that its waters, as well as its principal tributaries, flow directly into the reservation and cannot be diverted elsewhere. The general course of this river is north, but, gradually in varying to the west, it empties into the Big Horn at a point about thirty-five miles above the junction of the latter stream with the Yellowstone.

The valley proper is a narrow strip from one to two miles in width, bounded on either side by a broken line of hills and bluffs from 50 to 200 feet in height. The valley of the Yellowstone river also furnishes considerable land of excellent quality, well suited to irrigation. Along the south side of the river, the northern part of the reservation, there are 40,000 to 50,000 acres of bottom land. It is probable that one irrigation system could be made to supply the entire tract, but nothing will be done here at present, as the works in course of construction in the Little Big Horn and the Big Horn valleys will supply the Indians with all the land they can possibly cultivate.

THREE CANAL LINES.

Along Pryor creek and its tributaries in the extreme western part of the reservation, there is also considerable irrigable land, with an available water supply. Three canal lines have been surveyed on the reservation, but that on the east side of the Big Horn valley was selected as the one promising to meet most satisfactorily the requirements at this time, as it involved no excessive expenditures. The location of the head works, at the opening of the canyon, is a most favorable one, the river at this point being narrow, only 200 feet in width, a r.d the steep rock walls affording excellent anchorage for the diverting works.

MEANS FOR THE WORK.

The government paid the Crows for the ceded land $946,000, and of this amount $200,000 were set apart to be expended by the Interior Department for irrigation works in the Big Horn, the Little Big Horn and Pryor Creek valleys. A very important provision was made, as follows: "Not to exceed $50,000 shall be annually expended in performing this work of irrigation, and provided further that the superintendent in charge of said work shall, in the employment of laborers, be required to give preference to such Indians of the Crow tribe as are competent and willing to work at the average wages paid to white laborers for the same kind of work, and the laborers so employed shall be paid in cash."

The sum of $75,000 was set apart for the maintenance and management of this system of irrigation; $25,000 for the construction of grist mills, one to be located in each of the valleys mentioned; $20,000 for construction and maintenance of the sub-Indian depot, to be located on Pryor creek; $5,000, or as much as necessary, for building houses; $10,000 for repairing and improving the houses of Indians now erected on the reservation; $3,000 for the equipment of blacksmith shops; $552,000 appropriated and set



A BIT OF THE DESERT.

aside as an annuity fund; $46,000 to be expended for the purchase of cattle for the Indians. The balance remaining of the appropriation constitutes a fund to be expended for the benefit of the Crow tribe, under the direction of the Interior Department.

INTERESTING ESTIMATE OF COST.

Walter H. Graves, engineer in charge of the works, states that it is safe to estimate that the average cost of water per acre for the amount of land covered will not exceed $5 per acre. The estimated cost of canal ranges from $1,000 to $8,000 per mile, with an average of about $3,000. A description of the Little Big Horn valley would be practically a reproduction of what has already been given concerning the west Big Horn line. The total length of the line is about 106 miles. There are about 50,000 acres of irrigable land in the Little Big Horn valley. Plans contemplated at present, however, will only irrigate about one half of the amount of land estimated in either of the valleys.

THE INDIANS BEFORE AND AFTER THE IRRIGATION DEVELOPMENT.

The Indians composing the Crow tribe, inhabiting the reservation, number about 2,500. Many of them reside along the Big Horn and Little Big Horn rivers, a few along Pryor creek, and others along the Yellowstone. Some of them had gardens and small fields of grain before the government commenced this work. The plan followed out has been to utilize the greatest amount of water, irrigating the greatest area of land, and comparatively at the least cost. There is an abundance of good land, with an available water supply sufficient to furnish each family of the tribe with nearly 320 irrigated acres, and enough good grazing land for 640 acres to each family, and this will be the policy. After this is done there will still remain more than 2,000,000 acres of land for which the Indians will have no use.

HIGHLY CREDITABLE TO ENGINEER GRAVES.

The work has not progressed as rapidly as it might have done, owing to the fact that the authority rests with officials at Washington, who operate at this distance at considerable disadvantage. But so far as it has proceeded it has been done in a thoroughly satisfactory manner, and reflects much credit upon the ability, tact and patience of Walter H. Graves, who serves as the engineer and superintendent. Few people believed that it would be possible for Indians to construct the works as well and as cheaply as white men, but the experiment has been quite surprising to all who have noticed its progress. A correspondent of THE IRRIGATION AGE visited the agency in the latter part of August, 1894, and happened to be there on the day the Indians received their month's pay. He also saw them using their wagons, scrapers and plows, and doing as much work as the average white man would do.

WHAT WILL THE HARVEST BE?

The end of this experiment cannot be seen until there has been an experience of actual irrigation farming by the Indians. The soil, climate and water works are all that could be desired. Will the Crow Indians prove equal to the demands of a good standard of agriculture?

In the judgment of an unprejudiced observer, who has studied the matter upon the ground, and with the benefit of expressions of opinion from various individuals with different standpoints, it may be said that all depends upon whom the Indians shall have for a practical instructor—for "guide, philosopher and friend," in an agricultural sense. If the Interior Department sends out for this work some broken-winded spoilsman—an irrigator from Maine, or a farmer from New York City, for instance—the experiment must end in miserable failure. But if, with such sense as men use in their private affairs, superintendents are chosen from among the hard-headed farmers of the Gallatin valley of Montana, then there can be no question about the success of the undertaking.

It is sincerely to be hoped that no fatal mistake will be made at this late day. It would be a cruel and a needless thing to wreck such a hopeful experiment, touching the destiny of a race, in order to give a job to some unsuccessful politician who had failed to earn his living at his trade or profession.

ONE ASPECT OF SOCIAL REFORM.

BY CHAS. STIRLING, M. D., OF CALIFORNIA.

IT is a notable tact in the history of human events, that great reforms and great revolutions nearly always come about in the most unexpected ways. The inventor of gunpowder, in all probability, had neither thought nor wish for the downfall of the feudal system, the immortal Gutenberg, with his primitive printing press, was, no doubt, a devout son of that mediæval church whose foundations in Northern Europe were to be shaken into ruins by this same mighty invention. So, also, in these days it may be that the solution of this great problem of irrigation will be a very powerful help toward the solution of other problems even greater and more important still. All the signs of the times would seem to indicate that some very radical readjustment of our industrial, social and governmental institutions must be had in the near future, and such, we believe, is the more or less decided opinion of perhaps a majority of all intelligent men. The theory and practice of government and business as they have come down to us from our grandfathers, are not adapted, and cannot be adapted, to present day necessities, and the old-time theories and the actual facts of the present have been pushed so far apart that the breaking strain must very soon be reached. Steam and electricity will do for our generation very much what gunpowder and the printing press did for the ages of long ago, and only a little time is necessary to the working out of this conclusion. No wise man will attempt to outline the shape and form of the coming reform in all of its details, but government by corporations and trusts will not much longer be tolerated. As was foretold by the prophet Macaulay, the time is now very near at hand when our national territory will be all occupied or monopolized, when the cities of America will be as numerous and as popu-

lous as the cities of Europe, and when, according to the sayings of the wise men across the Atlantic, such a government as this cannot possibly stand the strain. Truly enough great changes are impending, but the great republic will still stand, to the confusion of kings and princes, and an example to their people. There is still an abundance of room in this *transmontane* region, but the western side of this continent cannot be occupied on the same terms as were the Atlantic States. So long as the discontented laborer could at any time take to the woods, or to the wild prairies, whenever the conditions were made too hard for him, he could not be starved into unconditional surrender, and not even such philanthropists as Pullman or Carnegie could crowd him into a very tight corner, and the Pinkerton men, the militia and the regular troops had no part whatever in the settlement of the labor question. Until very recently even the lazy, the shiftless and the ignorant could always find plenty of room and live in some sort of rough abundance, just beyond the frontiers of civilization, but for immigrants of the traditional Pike County sort there is no longer a place anywhere within the United States, and least of all in the land of irrigation. The lean-faced, yellow-skinned immigrant from Pike County, with his hungry-looking wife and dirty, ragged children, with the inevitable "yaller" dog and the kind of a horse that always goes with such an outfit; such immigrants cannot invade arid America at all; they would starve to death at the outset. California, Arizona and Nevada can never be settled on the same plan as Missouri and Arkansas, for example. It does seem as if Nature had reserved this side of the Continent until American civilization could furnish the right sort of immigrants in sufficient numbers to suddenly occupy the land and prepare the way perhaps for another great advance in social evolution. In most parts of the earth Nature seems to tolerate all sorts of human kind, or, at any rate, the process of weeding out the weaklings and incompetents seems to be exceedingly slow, but in this land of the sunset, where civilization must depend on irrigation, a certain and very respectable degree of intelligence is demanded of the farmer as the very first condition of success. In other irrigated lands, where there are masters and slaves, it is only necessary that the master should be intelligent, but Jupiter Pluvius will never abdicate his functions in favor of an ignorant clod-hopper. An irrigated farm demands rather a superior grade of intelligence and a greater degree of skill than a farm of the other sort; it is about the same comparison as between a fine Atlantic steamer and the ship in which Columbus sailed for America. To be sure, with irrigation the returns are far more certain, and beyond all comparison more bountiful, but as has been said so many times, the unintelligent, plodding, old-fashioned mossback is much better off in New England than he would be in California. Still one other very important difference in the settlement of the extreme West; the lone pioneer and the old-style Buffalo Bill sort of frontiersman have no part nor place in it. Colony settlement must be the rule, and the individual pioneer, pushing out for himself far beyond all settlements, will be the rare exception. The rough frontier life, such as has been known in all of the older States, will never be seen in the dry valleys of California. Civilization must invade these dry deserts in force or not at all. The invaders must come in bands and companies; the thin skirmish line of rough frontiersmen can make no lodgment here. The old familiar story of the early settlement of the Mississippi Valley States, in which fighting sheriffs, horse thieves, vigilance committees and border ruffians make up so large a part, will never be repeated in irrigated California. The transition between the hot, dry desert, bare of every green thing, even of weeds, and the finest gardens and orchards in the world, is extremely sudden in these parts. Still one further consideration which brings irrigated California at once and directly into line with the civilization of the future, and that is the fact that irrigation implies, and almost compels, co-operation or association. It is not often that the solitary rancher can find a water supply sufficiently abundant and reliable which he can monopolize. Water rights are generally very valuable, and often very costly, property, and many things are financially easy to the colony which would be quite impossible to the individual, and it has been demonstrated again and again that where one solitary family could not live at all a large community can live in rich abundance. And still further; in a land where nothing is possible without water, and where almost everything is possible with water, this all-important fluid cannot be made subject to monopoly, as there is a limit beyond which even trust and corporations must not pass under penalty of destruction. From force of circumstance, if from nothing else, the Californian must be an active partner in many plans of co-operation. As we have already noted, irrigation almost necessitates co-operation, and the various fruit growers' unions for drying, packing, shipping and selling the fruit seems already to include the greater part of the business in California. It is altogether probable that the co-operative plan will be more and more extended year by year, and made to include more departments of business. As co-operation has been found successful in a few things, the plan will be extended and made to rule over many things, and this will furnish a grand object lesson amid the disorder consequent upon the breakdown of the competitive system.





GOATS PUDDLING THE EARTHWORK OF A DAM IN NEW MEXICO.

INDUSTRIAL ECONOMY IN DAM BUILDING.

IN building irrigation canals and dams the engineer is often obliged to resort to the adoption of methods and means which seem totally foreign to the exact science of engineering. They apparently have no connection whatever with such abstruse matters as triangulation, cross sections or tensile strength, and it would scarcely be supposed that they could be considered as factors in an important engineering feat. Even the goat, loud smelling and of voracious appetite, fills a place in the industrial economy of dam building. It may be true that the goat is of humble origin, fit only to gorge itself on the Monday washing or empty tomato cans, but viewed in the light of the results accomplished, it is worthy of a higher place in public esteem.

Gen. E. F. Hobart, of Santa Fe, relates that while building a dam on the Rio de Santa Fe, to store water to supply the city and for irrigation purposes, over a hundred goats were used to puddle the earthwork. The foundation of the dam rested on bed rock, upon which had been built ribs of concrete and in these ribs was inserted triple sheet piling extending upward into the puddle. The entire upper half of the dam is puddled; the earth being spread in thin layers, then sprinkled and goats driven back and forth. The face of the dam was afterward covered with three feet of broken quarry rip-rap.

Mr. John Howell, a civil engineer of New York, afterward wrote that when the goats were first employed, several hundred were busy at once, usually between the hours of twelve and one and five and six. It was subsequently found that the goats did not interfere with the teams, and it would be more convenient and economical to use a smaller number of goats and keep them at work all day. As a result of this experience they found that 115 goats could do well the puddling for thirty wheel-scrapers, averaging about fourteen cubic feet per load on about 500 feet haul. As goats in the arid region are a dry hill-side animal, it was feared that such a radical change in their habits as keeping their feet muddy would give them foot disease, but their natural hardiness seems capable of carrying them through. When first put at work they tired easily and were able to work but a part of a day. A few days of feed upon peas and refuse hay, however, brought back their accustomed good spirits.

THE IRRIGATION OF THE VEGETABLE GARDEN.

BY F. C. BARKER, OF NEW MEXICO.

I SEE so many vegetable gardens irrigated in an imperfect and slovenly manner, and have so many inquiries as to how the irrigating ditches should be run, that I think an exhaustive article on the subject would be interesting to many of the readers of THE IRRIGATION AGE.

As nearly every garden will vary in extent, shape and level, it is impracticable to give a plan to suit all cases; but some general principles may be laid down, which can be applied to the varying circumstances. It is, perhaps, needless to say that the main irrigating ditch must run along the highest side of the garden. The question is what to do with the water when you have got it there. Let us presume that the main ditch runs along the northern boundary; then lay out the entire garden in oblong beds, about 16 feet long and 12 feet wide, with the narrow sides east and west. This will be a handy size for a garden devoted to family use; but they may be a little shorter or considerably longer, if it be necessary to curtail or enlarge them so as to fit any fixed number into the space it is intended to cultivate. For instance: If the garden is 72 feet wide, there will be, after allowance is made for the laterals, four rows of beds 16 feet long; or if it be 50 feet wide, then two rows of beds 23 feet long will just fill up the width of the garden. Surround each bed with a border about a foot high and two feet broad, and these borders will serve both as paths and to retain the water. See that each bed is perfectly level, although, of course, one may be higher or lower than its neighbor. Now, down throughout the garden, and running north and south, construct your lateral ditches, which should be about two feet wide, making the bottom of the laterals rather higher than the beds. The laterals should be so arranged as to have one row of beds on each side, as it is from these laterals you will irrigate your beds. To make the idea clear, we have spoken of the construction of the beds before that of the laterals, but as a matter of actual practice the laterals are more easily made first, and after you have planned in your mind how the beds are to run.

Count your beds, and for each one make, with one-inch lumber, a small box, four inches square inside and four feet long, with sluice-gate at one end. By a sluice-gate I mean a little trap door that slides up to let the water pass, or is put down to shut it off. Place this box in the bank of the lateral, so that the bottom of the gate end is on a level with the bottom of the ditch. Cover the box with dirt, pounding it around so that the water will not cut through along the side or bottom of the box. The boxes should be placed opposite one another and at a point to let the water into the upper corner of each bed. In the laterals make small checks or dams with a piece of lumber, six inches high, so as to bank up the water and throw it into the little boxes.

When you want to irrigate the garden, or any portion of it, let in the water slowly from the main ditch, and allow it to flow down the laterals. As it comes to the box of each bed, open the little gate and let the water flow gently over the bed. Do not have such a head of water as will wash the soil, and do not drown the plants by letting it stand too high; but when you consider enough water has been applied, shut off, and let the stream flow on to the next bed or pair of beds.

This method has many advantages over the slip-shod custom of tearing away the banks of the laterals and then building them up again as each bed is irrigated. In the first place, you are able to better regulate the flow of water and admit only as much as will do your work slowly and surely, allowing it sufficient time to soak well into the soil. You also avoid scouring and washing away the earth, and small plants being thereby smothered, as is frequently the case with the old method. I have also found that in many ways one has better control over the water, and the work of irrigation can be done with the minimum of exertion; indeed, the two or three hours it takes to irrigate my garden are the pleasantest and laziest of any evening in the week. All I have to do is to open the gates, light a pipe, and watch the water flow in.

The borders dividing the beds make convenient paths, and well-kept paths are a necessity in a vegetable garden, and not a luxury as many suppose. Not only are they needed for the purpose of getting about the garden to gather the crops and attend to the plants, but they enable the gardener to wheel in manure with the barrow with the minimum of labor. Although the plan sketched is especially applicable to a small garden cultivated with the spade, it will be seen that there is nothing to prevent the use of a horse plow after the crops are gathered, as the entire length of the garden may be plowed up, leaving only the laterals intact. Any of the beds may be devoted to permanent crops, such as asparagus, rhubarb, strawberries, parsley, etc., and these should be located all together and at one end of a row, so that the rest of the garden may be plowed with horse-power if desired.

The size of gardens and beds as sketched above is, it is understood, intended only for a garden to supply the family. Where vegetables are grown for sale, the beds may be very much larger, especially if the ground is tolerably level. Forty beds, 16 feet by 12, will, with the laterals, just about occupy one-fifth of an acre. For a commercial garden the beds may be 40 feet by 20, of which forty-eight would fill one acre. The same plan may be somewhat modified to suit an orchard where vegetables are to be grown between the fruit trees. The beds may then be made 24 feet by 12, or even 48 by 24, and the trees planted on the borders so that they stand 24 feet apart each way. I do not recommend planting trees in the vegetable garden, which should get all the sun and air possible; but for the first two or three years vegetables may be very profitably grown between the rows of fruit trees, which do admirably if planted on the narrow borders, raised six inches, which separate the beds, for in this position the trunk does not come in contact with the water, which should always be applied to the roots only.

Always apply water to vegetables in the evening as the sun is going down, or the hot sun on the water will injure and perhaps kill them. After each irrigation the soil should be stirred with a hoe, or, better still, you may get a small hand cultivator running on a wheel, and which can be bought for about $4. It is

quicker and does better work than a hoe, and can be set to plow, cultivate, or weed between the rows. Irrigate as often as the plants show signs of flagging. Large plants will, as a rule, not need water whenever the soil is wet enough six inches deep to roll up with your hands into a ball; but for small seedlings or newly-transplanted vegetables the surface must be kept moist. I do not mean that it should be wet or sodden, but it must not be allowed to go dust-dry. In very arid climates it is a good plan, whenever a bed is sown with seeds, to cover it with straw, brush or hay. so as to prevent evaporation. Of course, the covering must be removed as soon as the seeds are well up, or they will grow weak and spindly for lack of light and air. The covering is also useful as a protection for radishes, lettuce, peas and other vegetables that may be sown extra early.

The question as to whether the water should be applied to the beds by the flooding or by the furrow system depends upon the variety of vegetable cultivated and the quality of the soil. Where the soil is light and contains plenty of manure or vegetable humus, I have found the best results are obtained by leaving the beds flat and just running the water over them. There are, however, many crops, such as potatoes, strawberries and chilies, which need to be grown in furrows. The beds as planned may be utilized for either system.

THE WATER SUPPLY FOR WESTERN KANSAS.

THE BEST WAY FOR GETTING IT ON THE LAND.

BY G. D. BUCHANAN.

Read before the Farmers' Institute of Finney County, Kansas.

TO my mind, there is no other subject of such vital importance to people of Western Kansas at the present time as the water supply. It is natural that this should be so; because on the water supply and its development depend the success or failure of many hundreds of people, in an effort to make for themselves comfortable and happy homes.

As far as the supply for ordinary purposes is concerned, we know we have an abundance of water, even for the irrigation of market gardening; but my subject reaches beyond this, and requires me to say something in regard to the extent of the supply.

By reasoning from effect to cause, and from cause to effect, we may arrive at some conclusion relative to the extent of the supply. If we pump water into an inclined trough leading from the pump to a tank, we notice the water is of even depth at all points of the trough as long as the pump goes regularly, but as soon as the pump stops the head of the stream in the trough tries to assume a horizontal position, and thus follow the main stream down and out at the lower end of the trough. We thus see the upper end of the trough left dry while the current is running full depth at the lower end. If we then fill our trough with sand and apply water to the upper end, until it finds its way by percolation to the lower end, and then shut off the supply above, we will find the sand becoming dry directly, while the water will be still running at the lower end; and it will continue to run even after the sand in the upper half of the trough is free of water.

From these effects, then, and from the fact that there is no water held in suspense—of any consequence—by the earth and rock lying above our sheet water from which the supply can be maintained; and from the fact that we have had no rain for twenty-seven months sufficient to wet the surface to exceed ten inches, and from the further fact that our water supply has not perceptibly diminished through all this long-continued drouth, we reason:

First. That our main water supply comes from beneath the mountains to the west of us, and constantly maintains the surface of the sheet water at near the same point through drouth as well as flood.

Second. We reason that our water supply is abundant for the irrigation of all the land that will come under cultivation for many years to come. We arrive at this conclusion, not by observing the amount of water flowing to us from the west, but by noticing the amount that flows away from us on the east.

As concerning the best means of getting the water on the land, it, to my mind, depends much on the amount required. To irrigate small gardens where it is not deep to water, and where men want to water one kind of plants to-day and another tomorrow, I would think individual pumping arrangements the best and most convenient.

But for the general irrigation of farm land in the cultivation of alfalfa, wheat, the sorghums and other field crops, I most emphatically say that gravity is the best, cheapest, most convenient and only natural way of getting water on land in large amounts in Western Kansas.

There are two ways of getting water on our land by gravity. One way is to choose a suitable place on the river bottom and drive a trench to the west, less in grade than the grade of the river, until we reach a point in the underflow at least double the depth of the ditch we wish to fill, and then trunk, curb or tile the trench from a point before where its bottom first reaches the sand above the water to a point near its head, and beyond the latter point; wall the trench with an impervious wall, thus forming an immense spring and causing the water to find its way into the irrigating ditch through the conduit instead of following its natural course through the sand.

The other, and, in my judgment, the best way, in case the water supply should not be as abundant as we may suppose, would be by the use of the siphon.

All are no doubt aware of what a siphon is, and are also aware that our country falls to the east at the rate of seven feet to the mile. Then it must be plain to every one that if we were to make an immense well somewhere on the valley or in the river bed, and then by laying a pipe-line down the valley for a few miles, having its western end elbowed down into the water in the well; that by filling the pipe with water and starting it to run it would continue to run as long as the supply of water in the well holds out.

One advantage I see in this system is the fact that in case there should prove to not be water enough in one location, our siphon could have several arms like those of an octopus reaching out to different wells, which may be located any distance apart.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

Short, practical articles, notes of experience and observation, are invited from the readers of THE IRRIGATION AGE who are interested in the promotion of the idea of the small diversified farm providing to the fullest economical extent all of the various articles of food, clothing, etc., required by the family.

PLYMOUTH INDUSTRIES.

THE following is a brief extract from the report of the Committee on Industries of Plymouth Colony, and has cost much time and research in order to make it as nearly accurate as a matter of this kind can be. It has been prepared by Mr. J. C. Fortiner and Dr. L. S. Hall, who are well informed in regard to the many practical matters upon which the report is based.

MARKETS.

An examination of the shelves of perhaps fifty grocery stores in the Pacific Northwest failed to find on them any canned or preserved fruits, vegetables or meats with the brand of a packer located in that region. Jellies from Omaha, canned goods from California and the Mississippi valley, tomatoes and catsup from New Jersey, potato starch from New York and Maine, were found on the shelves of these stores.

Over $3,500,000 worth of butter, cheese and condensed milk were imported into the State of Washington alone in 1894, and about as much more into Montana, Idaho and Eastern Oregon. A million dollars worth of condensed milk was shipped from Puget Sound ports in 1894.

The Pacific Northwest is still importing all of its canned fruits, vegetables and meats, eleven-twelfths of its pork products, large quantities of condensed milk, about half of its butter, and almost all of its cheese. These products are 20 to 25 per cent. higher in price than in the markets of Chicago.

The demand for these prepared products of the farm being already in existence, a colony founded with a view of establishing factories to convert the products which they raise into the forms required by the markets is certain to be prosperous.

STARCH FACTORY.

The ordinary white potato for which Greeley is so famous, grows with equal perfection and in equal quantity on all the irrigated lands of the arid region. Responsible parties have informed the writers that they would be willing to plant 1,000 acres in potatoes if a price of 25 cents per bushel could be guaranteed. The establishment of a starch factory would enable this to be done, as the price paid by starch factories runs about 30 to 40 cents per bushel.

A starch factory, with very cheap frame building, could be established on a small scale for $2,500. This would work up the excess crop of a new colony, furnish a market for their small potatoes, and enable them to get a higher price for the selected potatoes.

EVAPORATORS.

When the fruit trees are in bearing, especially if the colony went into prune raising, evaporators would be a necessity. Fruit evaporators of a capacity of a ton of dried fruit per day can be built for $1,000 each. By means of the evaporator the surplus crop above requirements of markets for fresh fruit, and all fruit too ripe to ship, can be saved, and net the grower from 1 to 2 cents per pound for fresh fruits. In the case of black raspberries and cherries, about 4 cents per pound of fresh fruit would be netted.

CANNERIES.

The industry which will be of the greatest importance to a fruit-raising colony is the canning industry. In the case of a new colony, vegetables would be the first products they would raise. There would be a local market for a large quantity; but if a large colony engaged in their production, the local market would be over-supplied if they all had to be marketed fresh, and the market would be liable to be depressed to the point of unprofitableness. A cannery would obviate this, and would be needed the first crop year. Two classes of outfits could be used. One would be an outfit especially adapted to the making of jellies, jams, fruit butters, preserves, and the canning of tomatoes and fruits. An outfit of this kind, capable of handling 5,000 cans per day, in a cheap frame building, would cost about $2,500. This method of canning, with a preserving outfit, would add about ¼ of a cent per can to the cost. This outfit would not can peas or corn. The extra cost of outfit to can peas and corn would be $1,200. A factory to can 10,000 cans per day of peas, corn, tomatoes or fruit, in cheap frame shed buildings, would cost about $5,500. If the preserving outfit were desired, it would add $700. This includes power machinery for pitting peaches, apricots and cherries. The cheaper outfit would answer at the founding of a new colony. Recent California writers show that a fruit grower, canning his own fruit, will net 2½ cents per pound at present prices of canned fruits. After the third year a large amount of fruit vinegar could be made from overripe and imperfect fruit, and the preserving outfit could be used to good advantage in the manufacture of pickles.

As cabbage can be produced very cheaply, sourkrout could be made in large quantities.

PORK PACKING.

Attention has been called to the home market for pork products. As many as twenty-five hogs have been raised on an acre of alfalfa. With alfalfa and the refuse of the orchard, garden, cannery and creamery for feed, with the 25-cent wheat of the Pacific Northwest to finish them on, hogs must be a very profitable product. If fed on alfalfa and wheat, 3,000 pounds of pork per acre per annum would be a conservative estimate; at 4 cents per pound, this would net $120 per acre. A small packing house could be established in connection with other industries, for about $5,000, which would cure all the pork a colony could raise, and thus have the finished pork products for sale to the local market instead of importing them.

CREAMERY, ETC.

Until the home markets for butter and cheese are fully supplied, a condensed milk plant is not a neces-

sity, but it would be a very profitable enterprise. A creamery and cheese factory combined, capable of making 500 pounds of butter and 1,000 pounds of cheese per day, with necessary refrigerating machinery, handling the milk of 1,000 cows, can be built for $6,000. A smaller one, handling the milk of 500 cows per day, can be built for $5,000. If the refrigerating machinery was omitted and ice used $1,000 could be deducted from above costs. Good authorities on cow-feeding state that green alfalfa, or alfalfa hay, without roots, will produce fifty pounds of butter to the equivalent of a ton of hay, with good cows. At 20 cents per pound this would be $10 to the ton of hay. At six tons per acre the income from alfalfa would be $60 per acre for butter, in addition to about $10 for the skim-milk as hog feed. With larger crops of hay, better milk cows, and higher prices for products, the income from an acre of alfalfa may easily reach $150. The cow and the creamery have the advantage of enabling the colonist of small means to make a living from the date of his arrival on the lands, if a fodder crop is provided in advance, as it would be.

It is the opinion of your committee that a creamery should be the first industry created.

REFRIGERATING PLANT.

A refrigerating plant, capable of caring for the products of the creamery, pork-packing house and the local butcher's market, with space to store several carloads of fruit, could be built for $3,000. A larger one would be of great advantage in the mild climate of the fruit-growing districts of the Arid Region in preserving fruit and vegetables in the fall and carrying them late in the fall, when they would bring very high prices. The expenditure for the industries mentioned would be as follows, the creamery and packing-house using the general refrigerating plant.

Creamery	$ 4,000
Refrigerating plant	3,000
Preserving and canning plant	3,700
Small pork-packing house	4,000
Starch factory	2,500
Evaporator	1,000
Total	$18,200

A beet-sugar factory would be desirable, but as the smallest commercial plant costs about $250,000, it is impracticable for these colonies.

AN AUSTRALIAN COLONY.*

THE area commanded by the Rodney Irrigation and Water Supply Trust in the Colony of Victoria, Australia, is about 260,000 acres, and the object is to provide an efficient stock and domestic supply throughout the whole area, together with a system of irrigation.

The trust has an authorized loan from the government of £242,878 (over a million dollars), of which there has been advanced and expended about £100,000 (about half a million dollars). Payment of interest at 4½ per cent. per annum has been suspended up to the present, likewise sinking fund at 1½ per cent. per annum. The trust, however, obtain a revenue by striking a differential rate of 1s. 6d. in the £1 on all rateable property in the area. There is also a fair amount obtained from the sale of water for stock purposes. The water is obtained from the Goulburn river, diverted by the national channel from the Goulburn Weir, constructed and maintained by the Department of Victorian Water Supply.

The district, which is eminently suitable for irrigation and fruit-growing purposes, has made rapid strides during the past few years since the works of the trust have been in progress. An irrigation colony called Ardmona, containing 1,000 acres, has been formed within the area, which is rapidly becoming settled. Ardmona is commanded by the trust channels, and the dried-up paddocks of a few years ago are now smiling with verdure and studded with the neat little homes of prosperous irrigators. About 300 acres are planted with vines and fruit trees and are now under irrigation. One of the blocks is devoted to the growth of nursery stock. The Chief Engineer of water supply reports that on a farm near Ardmona, within the area of the Rodney Trust, there are sixty acres laid down in lucerne, divided into paddocks and kept under irrigation. This land has maintained eight sheep to the acre throughout the summer. The lucerne crop lasts for several months. The same farm has sixteen acres under mixed fruits and twenty acres under raisin vines, all irrigated and bearing a heavy crop of fruit of exceptionable quality.

From the regular Australian correspondent of THE IRRIGATION AGE.

Sorghum Cultivation.—A great deal of attention is being paid to the cultivation of this as a forage crop in Texas. A. M. Soule, of the Texas Experimental Station, says: The importance and value of the sorghum crop does not seem to be fully appreciated. The variety of uses it can be put to is very great; for instance, it makes a superior form of silage, is probably the most prolific and persistent of our soiling crops, makes a well-relished hay of high feeding value, yields luxuriant pasturage and is exceedingly hardy. An example of this last trait is found in the fact that it withstood the effects of the hot winds that prevailed over Texas for four days without cessation during the past summer, while the corn and other forage crops were burned to a crisp. It is said that such a destructive wind has not swept over the country in the previous thirty years of its history. This, combined with its well-known ability to resist drouth, renders it *par excellence* the forage crop for countries subject to such conditions.

From two or three cuttings a year, it will yield from ten to twenty tons of fodder to the acre from each; the maximum yields reach twenty-five to thirty tons. This is equal to four to eight tons of cured hay, which is a nutritious food for all stock.

Too Much Water Used.—A common fault with irrigators is the use of too much water. So glaring is this fault, in fact, that it may be safely stated that most men using irrigating water greatly overdo the matter, and fail of best results by their too-liberal use of the irrigating fluid. It is a very common sight in the irrigated regions to see a large quantity of waste water running away from orchards or fields, carrying much fertilizing material to be finally deposited far away from the land of the man who bought it, or perhaps in the sea itself. So common is it thus to mismanage irrigating water, that a constant source of neighborhood trouble is the waste water of one irrigator finding its way to some place on his neighbor's land where it is not wanted. In other cases, the neighbor on the lower side reaps considerable advantage in receiving much of the fertil-

izing material carried down with the water, which, for that reason, may be endured. A case of this kind lately came under the writer's observation. Mr. A had a fine orchard on a sunny slope, and being able to get a liberal supply of water he used it very freely, and greatly to the inconvenience of his neighbor adjoining below, who had alfalfa. Complaints did little good in staying the floods from the orchard slopes, and the alfalfa man finally changed his tactics. He detected a lack of nitrogen in the orchardist's soil, and recommended a heavy coating of sheep manure. The fruit man eagerly embraced the opportunity to add to the growth of his fine orchard, and literally covered the ground with the accumulations of an old sheep corral in the neighborhood, bought and spread in the orchard at a cost of four cents per cubic foot. His reckless waste of water resulted as the wily alfalfa neighbor expected. The latter merely prepared his ground to receive all the waste water, loaded with the newly applied fertilizing agent, and was thus greatly benefited, putting money in his purse at the expense of his careless neighbor.

Periodicity in Rainfall.—Chancellor F. H. Snow, of the Kansas Agricultural College, whose experience in recording the rainfall extends over twenty-seven years, says there is a periodical oscillation in the rainfall; the length of the rain cycle seems to be about seven years, that is to say, in each period of seven years there appear to be two or more consecutive years whose rainfall is above the average, followed by a similar series of years whose rainfall is below the average. An examination of the records also shows that the precipitation during the growing season, from March 1 to September 1, follows substantially the same seven year periodicity as the annual precipitation. It becomes, then, a question of great importance whether the excess of rainfall in the months and years whose precipitation is above the average cannot be stored in such a way as to be of service in the following months or seasons in which the precipitation is below the average. In a general way, undoubtedly, a large portion of the excess of rainfall may be stored in the soil itself after the surface has been broken by the plow. If the cultivated area of the semi-arid region were to be increased upon an extensive scale, a large portion of the excess of rainfall would be retained upon the area upon which it falls. The rains in Western Kansas are generally quite local, and consist of a heavy downpour in a comparatively short time. Long-continued, moderate or drizzling rains are almost unknown in that portion of the State. It is estimated that from sixty to ninety per cent of the rainfall runs into the streams, and is of no benefit to the region in which it is precipitated. The preservation of even a small portion of this waste of water would be of incalculable value for agricultural purposes. The conditions are favorable for the construction of artificial reservoirs in that part of the State upon almost every quarter section of land, without extravagant expenditure of time, labor or money.

Spray the Trees.—The Salt Lake *Tribune* urges upon the Legislature of Idaho the importance of compelling, under penalty of fine for neglect, the spraying of orchard trees, and suggests that when the entire fruit industry, which is now being established, may be subjected to injury through the laziness, or carelessness, or obstinacy of one man, it is of paramount importance. Utah has tried it for a single year, and its effects are enough to make friends for such a measure in every State. It is not an expensive operation, but it is an all-important one, and the statement is made, which is probably true, that the saving on a single acre of land is enough to pay for the work of spraying fifty acres. This advice is applicable elsewhere as well as to Idaho.

Vegetable Growing in South Dakota.—In writing of his experience in irrigating small tracts of land, S. M. Gibbs, of Groton, S. D., gives some valuable information. During last year, Mr. Gibbs planted several small tracts, upon which he could get water, with potatoes, tomatoes, etc. The potatoes yielded about 600 bushels to the acre, and this under circumstances which were by no means favorable. About an acre and a half of potatoes were planted in a small depression in the prairie, but late in June, after they had got fairly started, there was a terrific storm; in fact there was a fall of rain of six inches in three hours. This flooded the "patch" to the depth of two feet, and washed out over one-half of them, but in spite of this Mr. Gibbs harvested a crop from this spot four times as large as that of one of his neighbors from five acres of ground. Mr. Gibbs had the same successful result in growing tomatoes. If he had cultivated an acre in the same manner the yield would amounted to not less than $1,500. This experience but demonstrates what an immense factor in agriculture irrigation will become when we consider these results obtained from small tracts of irrigated land and the result from his 500-acre farm, which Mr. Gibbs says brought him only $2.50 an acre.

During the present year Mr. Gibbs expects to irrigate a larger body of land, and there are many other farmers in that vicinity who are intending to follow his example.

Need of a Forage Plant in Kansas.—R. A. Winters, of Atwood, Kansas, says that there is a need of a perennial forage plant on the plains of Western Kansas and Nebraska. Of the native plants, buffalo grass takes the lead. When there is lack of moisture it simply stops and waits until conditions are favorable and then goes on. It is a useful plant, but it is a dwarf. Then there is what is called the "soap weed," "buffalo pumpkins," and a species of "morning glory." These are all rank growers, have large, deep penetrating roots, and seem able to defy the drouth and the high winds, but they are practically of no value. What is really needed is a plant that can be fed to cattle, and will also have the drouth-resisting qualities.

The Millet Crop.—At the recent meeting of the Kansas State Board of Agriculture, Senator James Shearer made some pertinent remarks in regard to field grasses: "The almost complete failure of common tame grasses during the last dry season sets us to casting about for a substitute. As a substitute for tame grass we find millet very good. Two tons of good hay, and, if thrashed, fifteen to twenty-five bushels of seed per acre is a common yield, while a crop of corn will do better after it than after corn; but we would especially recommend it for a second crop, instead of having our small grain land lying idle half the season and growing to weeds. It can be put in much better condition for a crop next sea-

son by plowing as soon as possible after the small grain is harvested, and sowing with millet. Last year through dry weather and heat it lived, ready to start with the first fall showers, and, just before frost, one-half a ton to two tons per acre of good cattle hay was cut, leaving enough stubble on the ground to prevent soil blowing—an important item—for in many localities the drouth-resisting advantages of fall plowing cannot be reaped, at least on upland, for fear of soil blowing in the spring. By sowing at different times as needed, millet will make a substitute for pasture grass passable in quality and bountiful in quantity from the first heat of summer until first frost."

A Good Tree Protector Required.—"In many localities young fruit trees are, about this season of the year, attacked by pests which soon strip the trees of bark near the ground and thus ruin them," writes J. M. Goodwin. "The mountain mouse and rat of the Rocky mountain regions are, in many cases, very destructive to young orchards, but the worst pest is the rabbit, which strips off the bark and girdles the small trees from the ground up as high as they can reach. Some of the tree protectors are good, and one of the best and cheapest is that made by the Yucca Manufacturing Company of California. Another remedy is to surround young orchards with woven wire rabbit-proof fencing. In the Snake river valley in Idaho a cheap remedy against the ravages of mice and rabbits has been used to much extent, entirely keeping away these pests, but the trees fared about as badly as if stripped of their bark. Tarred paper, cut into sizes to go around the tree and lap over a little, was tightly tied with a string or wire. In cool or really cold weather no harm is done, but when the hot rays come in summer these brown, impervious wrappings fairly scorch the bark of the trees, and in many cases kill them. This experiment was tried on an orchard in Boise valley four years ago on trees in their second year from the nursery. Trees two years younger, planted in an extension to this orchard two years ago, are now about twice as large—none of them died—and present a striking illustration of the effects of overheating the bodies by being encased in tarred paper. There ought to be some remedy against these animal pests by coating the trees with some substance that will drive them away, but fruit growers differ much as to what should be used in that way. Lard, tallow, tar, petroleum and other substances have been used with unsatisfactory results."

The Potato Scab.—The potato crop is one of great importance to Wyoming. The fine quality and great yield have won several prizes for potatoes grown in this State, and as it is a crop which can be easily cultivated, and returns a good profit on the expense and labor necessary, the acreage should be largely increased. The disease which is most to be feared in growing potatoes is the scab. This is a wholly preventable fungus disease, and never occurs in clean soil unless germs are introduced with the seed. This scab greatly reduces the yield as well as impairing the quality. More than that, the fungus once introduced persists in the soil for a number of years. The Wyoming Experiment Station has given considerable attention to this subject, and Aven Nelon, the botanist, gives the following as a good method of treating the seed before planting: In about fifteen gallons of water dissolve about two ounces of corrosive sublimate (bicloride of mercury). In this solution immerse the seed potatoes for one and a half hours, after which spread them out to dry, and plant as usual. See that the potatoes are clean. Put them in a coarse gunny sack and place in the solution. As corrosive sublimate is a violent poison all animals must be kept away from the solution and the treated seed. The solution should be prepared in wooden vessels—a barrel, for instance, which after using, must be thoroughly cleansed or destroyed.

Texas Cattle Fever.—The Nevada Agricultural Experiment Station has issued a very comprehensive bulletin on the Texas cattle fever. For some time W. McN. Miller, special investigator of diseases of animals, of the station, has been giving close attention to an outbreak of this disease among a herd of cattle in Douglas County. The disease manifests itself by fever, dullness, diminished quantity of milk in cows, loss of appetite and a tendency to leave the herd. The temperature varies from 104 to 107.6 degrees, Fahrenheit, and the higher the fever the sooner comes the fatal ending. Infected animals usually die after from three to ten days. A most important thing to notice is the presence of small ticks, which are rarely seen on native Nevada cattle not affected with the disease.

Preventive treatment embraces first, the removal of the affected herd, sick as well as healthy animals; second, the destruction of the ticks by currying, collecting and burning, and by the application of insecticides; third, the administration of quinine sulphate in doses of thirty grains daily. It should be moistened with two tablespoonfuls of alcohol, and then added to a pint of water. To cure the developed disease, the temperature of all animals in the herd should be taken systematically with an ordinary physician's clinical thermometer, and to those whose temperature exceeds 103 degrees there should be given 150 grains of quinine sulphate, this to be followed by doses of thirty grains daily until tempera- is reduced.

How to Kill Cutworms.—Young corn is frequently seriously injured by cutworms, but preventive measures differ with the various species. In dealing with them where they are scattered over a large area, probably the most successful method is by the distribution of poisonous baits, says Prof. Riley. These may consist of freshly cut clover or other succulent vegetation poisoned with Paris green, and made into balls or gathered into masses, so as to prevent their too rapid drying. One mode of accomplishing this last object is by covering the poisoned plants with boards. These poisoned baits, if placed at intervals along the corn rows, will attract a large proportion of the cutworms, which, by feeding upon them, will perish. For smaller areas, or for garden patches, the same method may be followed, or the larvæ may be unearthed from about the base of the plants, where they retire for concealment during the day.

Another method is to take a smooth walking cane and make smooth holes several inches deep at intervals, going over the same ground every day and punching in these holes to destroy the worms which seek them during the day as a place of concealment and tumble in. The patent salts, such as kainit, have proved of the greatest value against many subter-

ranean insects, and undoubtedly will be of value against these cutworms. They have the additional advantage of being good fertilizers, so that their expense as insecticides is more than offset by their value to the crop and to the land.

Artesian Investigation.—An association has been formed in Los Angeles county, Cal., for the purpose of investigating and making a complete report of the artesian water supply. The association expects to prepare a complete map of the Antelope valley, showing the location of the various wells, to be accompanied with a complete report containing all the information it is possible to gather. J. Howard Russell, of Lancaster, Cal., has the matter in charge.

Fertilizers in the Irrigating Water.—In some localities the notion prevails that the irrigating water can always be relied upon to supply any lack of fertility in the soil, but such is manifestly not the case. A certain amount of humus may no doubt be deposited during some irrigations when the water is filled with sediment due to recent freshets, but often this condition is found to work inconvenience, if not actual damage. In any event, the use of fertilizers should not be considered unnecessary.

Cost of Drying Prunes.—C. G. Shaw, a leading grower and packer of Italian prunes, at Vancouver, Washington, informs the *Northwest Horticulturist* that a fair estimate yield of the number of pounds fresh fruit per tree, for crops each year after prune trees are seven years old, is about 100. He says: "The charge per pound for drying fruit through this fruit belt is ½ cent. This is enough, and a man can make good interest on his investment at that rate, The actual cost of drying is ⅜ of 1 cent; so the man who dries fruit at price stated will clear one-fourth of the ½ cent per pound, or $2.50 per ton."

Pruning Trees in Summer.—This is generally effected by pinching off the soft ends of the side shoots after they have made a few inches' growth. In these the sap immediately accumulates, and the young buds upon the remainder of these shoots, which otherwise would produce leaves, are gradually changed into fruit buds.

It often happens, and especially when the pinching is done too early, that the new buds send out shoots a second time the same season. When this occurs these second shoots are to be pinched in the same manner as the first, but shorter; and the third ones, should they start, are to be similarly treated. The bruising giving by pinching off with the thumb and finger is more apt to prevent this result than clipping with a sharp knife.

Very fine trees have been produced which never had a saw or knife about them. The thumb and forefinger only had been used. Rub off all unnecessary buds that grow on a tree, and remove as they appear. This is easily done, keeps the tree clean and growing in the proper channel. It is no doubt the best system of training trees where the orchardist can give the proper attention at the right time.

Do not let a lazy pig miss its meals and become stunted. It will burrow itself in a pile of bedding and be content to almost starve itself rather than to turn out of a warm bed on a cold day.

The California Prune Crop.—The crop was a light one last year, and probably did not go beyond 35,000,000 pounds of cured fruit. In 1892, the State had 25,328 acres of bearing prune orchards, and 24,298 acres not yet of bearing age. The prune tree begins to bear the fourth year from planting. It has thus far proven one of the most profitable fruits grown in California. In 1893, the California prune crop reached about 50,000,000 pounds, while the raisin crop was over 85,000,000 pounds. For the year ending June 30th last, 9,908,122 pounds of foreign prunes were imported into the United States, valued at $416,342, and 13,751,050 pounds of raisins, valued at $554,090.

Apricots.—Nine-tenths of all the apricots produced in the United States are grown in California. In 1892, there were 5,776 acres of bearing apricot orchards in that State, and 19,831 acres not yet old enough to bear. The yield of cured apricots from last year's crop was about one thousand carloads, the largest ever produced in the State.

Twenty Dairy Points.—A. E. Jones, a successful Western dairyman, whose cows are registered Jerseys, which make over 300 pounds of butter a year, writes to the *Farm and Dairy* as follows:

My eight years' experience in dairy work has led to the following conclusions, viz.:

1. Get rid of the scrub cow.
2. Good cows lead to better methods.
3. Without good feed dairying is a failure.
4. People will not pay twenty-five cents for ten-cent butter.
5. It requires brains and gumption to succeed in the dairy.
6. A careless person cannot make good butter.
7. Promptness and honesty always win.
8. The finishing touches are what pay.
9. Cows need shelter from storm and sun.
10. Clean hands invite clean methods
11. A prosperous dairyman is always gentlemanly to his customers.
12. When serving customers always wear clean clothes.
13. Those that make bad butter are easily offended.
14. If you do not like the work, quit.
15. Good butter cannot be made where the surroundings are filthy.
16. Poor butter gives the dairyman a lean purse.
17. There is a growing demand for good butter at paying prices.
18. Badly made butter hurts the trade and gives the oleo. men a better market.
19. Kansas needs a dairy school to educate the people in this work.
20. Keep pace with the modern improvements.

Relief for a Choked Animal.—Cattle having access to apples or potatoes are liable to be choked in the attempt to swallow them without sufficient mastication. Valuable animals are often lost from this cause and a great variety of remedies have been suggested from time to time. A Vermont farmer of much experience recommends the following: Pour down the throat of the animal a solution of three tablespoonsful of common baking soda in a quart of water. This should generally relieve the animal in the course of two or three minutes.

Careful Selection Necessary.—Now that we have free foreign wool, it behooves American flock masters to look sharply after their sheep. Only the best breeds and the best specimens of each breed should be kept on the farm, due account being taken of the use to be made of the animal. While free wool may make sheep kept for wool less profitable, it is not impossible that there will still be good money in the mutton breeds. In any event, and for whatever purpose sheep are kept, they should be well cared for. If they are worth keeping at all they are worth the care needed to make them profitable.

Disadvantages of a Square Acre.—A square acre plowed with a fifteen-inch furrow requires eighty-four rounds and 336 turns, while the same area in the form of a parallelogram, two by eighty rods, requires only thirteen rounds and fifty-two turns. In the one form it will take twice the time to plow that it does in the other, to say nothing of the serious tramping which the square piece will be subject to.—*Exchange.*

Photographs Wanted.—Photographs of notable farm animals, fruits, vegetables, farm buildings, persons and rural scenes are desired for reproduction in the pages of THE IRRIGATION AGE. Our aim is to illustrate the magazine as fully as possible, and there are probably no pictures of such living interest as those of everyday scenes.

The State Horticultural Society of Mississippi has agreed upon a scale for hired labor this season as follows: Male hands for orchard and garden work, $10 a month, or fifty cents a day; women to be paid forty cents a days; strawberry pickers one and one-half cents a quart; all fruits and vegetables to be gathered by the box or bushel, and hands to be paid accordingly; skillful hands are to be paid $11 a month. The committee reported "that owing to the low prices of fruit and garden truck the fruit growers were forced to this action." Do the laborers of the West care to compete with these prices?

The day has passed into oblivion when a farmer is measured by the superior feats that he can perform, such as how many acres of grass have fallen before his scythe to-day, the field of corn that has received his attention, the tons of hay yielding to his giant-like strength. This is a day of brains. The question is, "What is the strength of his brain, rather than the capacity of his muscle?"—*Committee on Education, Maine State Grange.*

Turkey gobblers and the old speckled hen don't care a snap for free trade or high tariff, but manage to scratch around, flap their wings and make a living whether there is a dollar of gold in the treasury or not. Many a flock of poultry has clothed the farmer's family and paid his taxes.

At $4 per barrel, the cost of flour in a pound of bread is 1½ cents. Add half a cent for the shortening and salt. These, with the cost of labor, rent, interest on investment, and expense of selling ought to be covered by four cents for the one-pound loaf.

When the tree bears a large load of fruit and the wood growth is small, do not prune them that year, but give them time to get more wood.

Farmers' Institutes and neighborhood libraries' which are being organized and established in many parts of the arid region, are not only evidences of exceptional intelligence in the respective communities, but they are most active factors in creating financial prosperity. They cost but little. Their value is incalculable.

Dairying to be successful must be conducted on business principles. Good cows, good feed, intelligent management, are the essentials.

Chaff is not wasted in the poultry yard. Use liberally, change frequently.

Always save the refuse, when cleaning the hay loft, for the poultry yard. Every seed is utilized; weed seeds are destroyed.

If your products, whatever they are, have a good reputation, a sale is easily effected, regardless of the general maket condition. Nothing is more valuable to the farmer, considered as to profit making.

Liberal feeding of boiled oats and good sound wheat will stimulate egg production in the winter, and its effect will be noticeable upon scrub stock as well as thoroughbred.

Every farmer should know the exact size of his fields and their acreage, so that he may properly apportion seed or manure. If he cannot afford a tape line, there are even cheaper substitutes, but he can not afford guess work in place of accurate calculations.

Soak corn for your fattening hogs. Nothing pays better. It is ready for digestion and all the constituents will be more fully assimilated.

Cabbage worms may be destroyed easily by sprinkling the plants with a solution of saltpetre, a tablespoonful dissolved in say ten quarts of tepid water. If the worms reappear sprinkle a second time.

An old English gardener says that a circle of beans planted about melon or cucumber hills will effectually keep away the striped bugs, which often prove so persistent a pest.

The acreage to be planted in fruit the coming season in Larimer County, Colo., far exceeds that of any previous year.

An earnest effort is being made to secure the payment of bounty by the state of $2.00 per ton on sugar beets, equal to one cent a pound on the sugar product.

F. M. Honey, of Ontario, Cal., after five years' experience, has decided to abandon fig growing, and will root out all his figs and plant orange trees. The trouble seems to be in proper ripening and curing. The trees grow finely, but there is no profit in them.

At the last cultivation of corn next summer, sprinkle a little rye through the field and see how it will help the lambs get ready for winter.—*Dakota Farmer.*

THE QUESTION BOX.

The Question Box shall be an "open parliament" for the discussion of the practical, every-day questions that perplex the irrigation farmers. Questions will be answered by those men of long experience among our readers who are glad to give of their knowledge for the common good. Further answers are solicited from any reader whose experience differs from that published here. THE AGE reserves all rights of control of the department.

Potato Cultivation.—What kind of soil should they be planted in? How often should they be irrigated and cultivated? Is it better to have the ground level? J. F. M.

In the spring of 1894 I erected a small irrigation plant consisting of an eight-foot windmill attached to two four-inch pumps and with this plant I irrigated some seven acres of ground which I planted to potatoes. The yield was four hundred bushels of sweet potatoes to the acre and three hundred and fifty of Irish. The following is my method of planting and cultivating: First—I select ground as nearly level as possible so as to have complete control of water while irrigating. If the land is not level it should be graded I now plow and prepare the ground, plowing eight to ten inches deep, afterward thoroughly harrowing and pulverizing the ground. Being now ready to plant, with a fourteen-inch stirring plow, I run my furrows about three feet apart and as deep as the plow will run. I fill the furrows with water and as soon as the water sinks away, put in the seed (which has been previously cut one or two eyes to the piece), dropping one piece in a place, ten to twelve inches apart in the row, covering the same by leveling the ground enough to outline the rows. I cultivate with a five-toothed cultivator, not being particular as to how many plants are covered up, as I think the covering does them no harm at this stage and protects them from the bugs, and at the same time destroys all weed seed starting. Now with a large single shovel plow, I run a furrow between each two rows and in these furrows turn the water, being very careful not to run it over the tops of the rows, and leave the water run until it has soaked to the roots of the potatoes. As soon after each irrigation as the ground will permit, I cultivate as before with a five-toothed cultivator, keeping the ground well stirred to prevent its baking. As to the amount of water or number of times to irrigate a crop, we must be governed by condition of soil and amount of rainfall. It is very essential, and in fact, we might say, the crop wholly depends on, having the ground wet while the hot winds are blowing. As to the kind of soil and sub-soil, I have a variety on my farm, varying from a light, sandy loam to a stiff joint clay (or hard pan). I have tried growing potatoes on these various kinds of soil and find the sandy soil with open, porous subsoil the best adapted to successful potato growing. JOSEPH HUFFMAN, of Garden City, Kan.

When is Water Needed?—At what time should fruit trees be irrigated? Does it depend on the season or the needs of the trees? C. F. W.

Irrigation is a science that requires the closest study of plant life. I note that most of the articles upon the time to irrigate trees are based upon the season of the year.

My eleven years' experience in irrigation in California teaches me that one might as well fix the time of year to feed and not to feed live stock.

The nature and requirements of the tree, in a great measure, fix the time to irrigate.

Each variety of tree and vegetable has a particular time when it wants water to do it the most good. To illustrate, a walnut should be properly irrigated at the time the young leaves are just bursting out, and again just at the time the young nut is setting (and bear in mind that the ground should always be kept moist the year round for all trees and vines in all frostless belts); and again, the orange should be thoroughly irrigated at the time the young leaves of the new growth are just putting forth and not yet unfolded.

If corn cannot have a good irrigation at the time the silk appears, it is substantially wasting water by irrigating two weeks thereafter, as far as the development of the ear is concerned.

A very close study of any one variety of tree for a year or two will soon convince the irrigator that the tree will follow the season and that water must follow the requirements of the tree. C. P. DEYOE, Santa Ana, California.

Crops for Young Orchards.—A. D. T.—Please inform us new beginners what hoed crops may be grown at a profit in a young orchard. How about strawberries? May other roots than potatoes be cultivated without harm to the trees?

Any kind of small fruits, such as raspberries, strawberries and blackberries. Onions will prove to be one of the most profitable crops when soil and climate are adapted. They are very prolific, easily kept and are always staple. ROBT. M. PRATT, Wichita, Kan.

Pumping from Deep Wells.—A. F. S., Nebraska—We have some rich table lands, but they are high, and the swells vary from 100 to 200 feet and more. Would like to irrigate, if only a garden spot. Can you give us the experience of those who have tried deep-well pumping? Give depth of well, size of cylinder and discharge pipe, power used, amount irrigated, and the success.

Caroline Moran, of Weskau, Kan., has a 6-inch well 160 feet deep, which is many miles from either river or creek, the average depth of water in the well being twenty feet. The pump, which is operated by a windmill, throws a stream two inches in diameter, or about 300 gallons an hour. The water is used for stock and domestic purposes. The cost of pump and well was $250 Ed. Carter, also of Weskau, Kan., irrigates an orchard from a 6-inch well 140 feet deep, operated by a windmill; cost of plant, $200.

Petroleum.—California now ranks fourth among the petroleum producing States. According to the twelfth report of the State mineralogist, this industry is assuming an increased importance, as at the present time Ventura County has over 150 oil wells, Los Angeles County 40, and Kern County 20. The report deals with the various mineral resources of the State at length, and those interested in the subject may obtain a copy free upon application to the State Mining Bureau, 24 Fourth St., San Francisco, California, by remitting ten cents to cover postage.

MAXIMS FOR THE IRRIGATED FARM.

A SIMPLE fact, briefly stated, will often stimulate thought more than a column-long treatise. These brief sentences are intended to be suggestive—a condensed expression of accepted truths and wise precepts.

A great calf may become a poor cow.

Selfishness is simply the opposite of "Do as you would be done by."

Some bigoted people resemble potatoes, in the fact that they have eyes but no not see.

Insure your crop with an irrigation ditch, as well as your house with a policy.

"Keep under cover" applies to farm machinery and animals.

"Success under difficulties" is incorrect; success is on top, not underneath.

Measure not a man's working capacity by the size of his mouth.

Farm philosophy should consist not in abstruse theories, but in practical experience.

"Bend not the knee to false gods" doesn't refer to the weeds in an onion bed.

Perseverance in the performance of duty and silence is the best answer to calumny.

Country prisoners have good appetites. If they eat they should be compelled to work—on the roads.

Well put—it is better to dam the draws than to damn the country.

There may be a "tide" in the affairs of man, but remember that it is not a "gulf stream."

The lazy man wishes he had worked harder when harvest time comes.

Keep salt in places where the stock can help themselves.

Spores of mold which drop into the milk will propagate to the great harm of the milk.

Bordeaux mixture applied early in the spring will prevent fungus growths on apple trees.

Speak of results when they are accomplished—not before.

It *is* possible to get a hog too fat.

Take time to be pleasant and cheerful, and get acquainted with your family.

Keep your chickens warm and dry; getting wet will soon kill the young ones.

"It's a long lane that has no turn," but a good road makes the distance seem short.

It is sometimes possible to have too much machinery; a little "elbow grease" will show better results.

The reign of the "triple alliance" kings, corn, cotton and wheat, is tottering to its destruction.

A little water will accomplish great results—at the right time.

Success usually means the practical application of other's experience.

Some consideration is shown the farmer's boy, but why should the girls be neglected?

It is sometimes of great advantage to resemble a hen, at least in having the ability to scratch gravel.

New converts to the doctrine of irrigation may be enthusiastic, but they lack experience.

It is folly to skip from one crop to another in the hope of catching the market at "high tide." A well-selected variety pays better.

Good roads pay large dividends on the original investment.

How *not* to do it is sometimes of great importance.

A rusty machine is an expensive labor-saving device.

"Four feet in the trough" seems to resemble the attitude of some land companies toward progressive legislation.

Women help every good thing, and now they are giving their attention to promoting good roads.

The main point of a good poultry house is that it should be warm, convenient and clean.

The successful farmer keeps up with the times. Constant improvement is imperative.

It is a narrow man who depreciates the value of a good education to the farmer.

There is more heat in the snow in the mountains (when converted and utilized) than in coal.



PULSE OF THE IRRIGATION INDUSTRY.

COST OF IRRIGATION CANALS.

THE county surveyor of Yakima county, Washington, Mr. G. C. Mills, has prepared the following statement for the Yakima Commercial Club, showing the mileage and cost of construction of irrigation canals in that county:

CANAL.	Completed. Miles Long.	Miles to be Completed.	Acres Reclaimed.	Acres to be Reclaimed.	Acres under Cultivation.	Acres for Sale.	Cost to date.	Cost for Completion.	Delivery, Cubic Feet per Second.	Cost of Reclamation per acre.	Estimated Acre Cost of Reclamation.
Selah Valley	22		4,000		610	3,390	$ 84,000		40	$21.00	
Yakima Valley	16		3,000			3,000	55,000		25	18.33	
Tacoma & Yakima Land Land Co	12	24		8,700			43,000	90,000			$15.28
Natchez and Cowiche	7		3,000		3,000		14,000		28	4.66	
Union, Broadgauge & Shan'o	16		5,000		4,500		18,000		45	3.60	
Moxee Canals	33	18	5 050	3,000	2,150	2,590	41,000	20,000	140	8.20	6.66
Moxee Artesian Wells (7)			1,250		550	700	12,000		8	9.60	
Yakima Improvement Co	42	18	50,000	14,000	9,860	32,000	600,000		700	12.00	10.71
Yakima Imp. & Irri. Co., 3 canals	51		17,710		1,100	16,610	100,000	150,000	329	5.64	
Prosser Falls Irrigation Co	8		3,000		350	2,650	42,000		28	14.00	
Prosser-Priest Rapids	18	38		60,000			72,000	300,000			6.20
Ahtanum Valley	100		16,000		16,000		25,000		100	1.56	
Natchez Valley*	12		8,000		8,000		6,000		80	.75	
Wenas Valley	8		4,800		4,800		7,400		36	1.54	
Cowiche Valley	12		4,000		4,000		6,000		35		1.50
Sunnyside High Line		90		120,000				1,200,000			10.50
Columbia River High Line		75		100,000				500,000			5.00
Indian Reservation, Low Lines		42	14,600	87,000	14,600		9,700	560,000	170	.66	6.43
Indian Reservation, High Lines		32		24,000				195,000			7.70
Totals	383	337	139,410	416,700	69,520	60,940	1,135,109	3,075,000	1,764		

It is a worthy example for other county surveyors to follow, as furnishing interesting and valuable information to the general public. It is impossible to estimate with any degree of certainty the cost of the smaller canals built on the coöperative plan, owing to the lack, in most cases, of an exact system of bookkeeping. Each farmer simply doing as much work as possible, and no record being kept, a large part is forgotten. Thus, when the cost is calculated after the canal is finished, it is invariably greatly underestimated. In many cases old canals or creek beds have been utilized thus saving great expense.

SHOULD VISIT PECOS VALLEY.

The Fourth National Irrigation Congress should not be allowed to pass without the management making something more than a local entertainment of the occasion. If possible, the delegates and visitors should be taken down the valley of the Rio Grande from Albuquerque to El Paso, where the redemption of a vast country is to be accomplished by a storage system, if at all, regarding which interstate, national and international questions may arise. The excursion should also be arranged to include the famed Pecos Valley in New Mexico, where the almost unlimited use of capital, directed by energy and ability, has established the largest storage system in the country. For educational reasons this part of the excursion should not be omitted, as it is certainly a striking object lesson of what can be accomplished if the proper forces are utilized in a systematic manner. These two immense valleys are in a sense types—one in a primitive stage, and the other with a system, vast, comprehensive, perfect—and it would be a great loss should the representatives of irrigation miss the opportunity of inspecting them.

COUNTY FAIR PRIZES.

The development of the agricultural and horticultural possibilities of the entire West has always been a subject of great interest to THE IRRIGATION AGE. At all times it has advocated the adoption of the best varieties of farm and orchard products, and the improvement of these varieties under the varying conditions of soil and climate. The better class of products not only yield more, but bring higher prices, and poor quality, whether in onions or oranges, should not be tolerated.

In order to further encourage those farmers and fruit growers who are striving to raise only the best, THE AGE has decided to make an exceedingly liberal offer, and one of which advantage will undoubtedly be promptly taken. The States of Western America are divided into over seven hundred counties, and very probably each county will hold a fair during the present year. It is the intention to give a year's subscription to THE IRRIGATION AGE *free*, as a special prize, for the best exhibit of agricultural or horticultural products grown by irrigation at each of the many county fairs.

When it is understood that this means an expenditure of $1,400, the extent of the generous offer can be more readily comprehended. The conditions concerning these exhibitions will, to a great extent, be left to the officials who have charge of the fairs. It should be remembered, however, that no prize will be awarded for products not actually raised by irrigation. In order to arrange the matter as soon as possible, THE AGE would be pleased to hear from those interested at once.

THE SOUTHERN IRRIGATION CONGRESS.

Interest in the subject of irrigation is looking up in the South. It is proposed to hold an Irrigation Congress in Atlanta, Ga., October 7, 8 and 9, during the Cotton States and International Exposition. The General Assembly of Georgia unanimously tendered their legislative halls for the use of the Congress and kindred bodies. Major W. G. Whidby, who has the work in hand, has appointed Col. Wilberforce Daniel, of Augusta, Ga., sergeant-at-arms; Capt. F. L. Hudgens, of Clarkston, Ga., door-keeper; Miss Grace Brasington, of Cincinnati, postmistress; and seven pages. Col. Daniel is said to be one of the finest specimens of Southern manhood, and Miss Brasington one of the most attractive, intelligent and *distingue* women in Ohio.

THE ATLANTA EXPOSITION.

The Cotton States and International Exposition, which opens in Atlanta September 18 and continues until the end of the year, promises to be highly successful. The National Government has appropriated a large sum of money for an exhibit, and several foreign countries have signified their intention to take part. The domestic displays will be on a scale of large magnitude.

WINDMILL IRRIGATION IN THE LODGE-POLE VALLEY.

There are at the present time quite a number of farmers who are irrigating tracts of land of various sizes by the use of windmills. In Deuel County, Neb., some of these plants are capable of pumping from 100 to 150 barrels per hour, and with a reservoir which will hold several thousand barrels there need be no fear of being unable to raise more than sufficient "to keep the wolf from the door." Among enterprising farmers who have adopted this method of irrigation might be mentioned Newman Bros., Mr. Ain Treat and Mr. Oberfelder. The land which is thus irrigated is planted with small fruits and vegetables. Mr. Oberfelder expects to set out fully a thousand cherry and plum trees this spring. Windmill irrigation is rapidly becoming an important feature in the agricultural problem throughout Nebraska and Kansas.

SOUTH DAKOTA ARTESIAN SUPPLY.

Irrigation has received but little attention in Turner County, S. D., for two principal reasons, writes B. W. Humler, of Parker. First, crops have usually been very good (with the exception of the past year, when this and other States suffered from drought) and irrigation was not needed. Second, this county is outside of the main artesian area, and flowing wells are not a success here. The eastern limit of the main artesian basin crosses the extreme southwest corner of this county on an irregular line, connecting Vermillion and Mitchell. Then, too, in the vicinity of Parker, or, in fact, in the north one-third of the county, there is the archaic formation, and whenever deep wells have been bored the quartzite of this period has been struck and no attempt has been made to bore through it in this county. This rock is not met with in the southern part of the county, and some deep wells have been sunk, but there is no report of any being flowing wells. Since the past season has demonstrated the fact that it is possible for rain to be withheld here, more attention will probably be given to irrigation.

IRRIGATION ENGINEERING.

The necessity for irrigation throughout nearly all of Western America, which in so many cases requires extensive reservoir and canal systems, creates a demand for engineers especially trained for irrigation work. It is in pursuance of this idea that the State Agricultural College of Ft. Collins, Colorado, established some years ago, a well-equipped department devoted to irrigation engineering and hydraulics, over which Prof. Louis G. Carpenter presides.

Some of the leading topics on which lectures are delivered are water supply measurements, duty and storage reservoirs, and methods of irrigation.

MESSAGES FROM THE GOVERNORS.

Governor McConnell, of Idaho, recommends to the legislature of that State that it shall memorialize congress to either aid the State by an appropriation to assist in irrigating the arid lands, or remove the restriction upon the price. It appears that the conditions under which grants of some 622,000 acres have been made to the State include a minimum selling price of $10 an acre, rendering it practically impossible to make sales, especially in competition with the government itself, which is selling similar lands at $1.25 per acre.

The message of Governor Thornton, of New Mexico, to the legislature, and also his report to the Secretary of the Interior, are at hand. Both are very carefully prepared, and represent the thorough knowledge which Governor Thornton has of the Territory through his long residence, as well as the recommendations of a practical man. Either of them will be valuable to parties desiring information as to the Territory.

THE BOISE AND NAMPA IRRIGATION AND POWER COMPANY.

The canal known as the "Ridenbaugh Ditch," taking its water supply from the Boise river, has again changed hands. Under foreclosure it had passed into the ownership of Messrs. Taylor and Satterfield, two Standard Old Company magnates, residents of Buffalo, N. Y. While waiting for the term of redemption to expire both of these gentlemen died, during the past year. The property passed to their estates. It has recently been purchased by Mr. R. E. Green, a civil engineer, formerly of Buffalo, and Mr. Jas. E. Jennings, of Salt Lake City. The canal covers and can furnish ample water supply for 125,000 acres.

TRANSPLANTING TO COUNTRY HOMES.

The work of transplanting unemployed, or poorly-employed individuals and families from congested centers of population into agricultural districts, which was begun last spring under the auspices of the Civic Federation, of Chicago, is now resumed under the same superintendence by the Bureau of Labor and Transportation, an organization bearing the name by which the work was known then, but duly chartered and incorporated.

Several things have been demonstrated: That there is a demand in the country for the surplus labor of the city; that a considerable percentage of the unemployed are willing to turn their backs on the allurements of city life and accept work on farms; that the railroad corporations are willing to aid in such transplanting, and that such work can be successfully prosecuted at a small per capita cost.

This work in all its ramifications is philanthropic in a very true and broad sense. It does not go to the slums with counsel merely, nor with ordinary relief, but extricates from the mire of despondency and helplessness into which men and women are sunk and sets them on the firm rock of self-support. It helps to self-help. It converts consumers into producers. It secures aid on business principles from the employer to the employed, the farmers sending half the railroad fare as advance wages, the railroads donating the other half.—*Chicago Inter Ocean.*

AGRICULTURAL IMPLEMENT EXHIBITION.

The Imperial Society of Agriculture, in Vienna, has decided to hold an international exhibition of agricultural implements and machinery at Vienna during the month of May, 1895.

ARIZONA.

From a small beginning, already satisfactory results have been obtained in ostrich farming in Maricopa County. The ostrich farm, situated three miles west of Phœnix, has now forty-nine grown birds and one chick. Some years ago, the owner of the ostrich farm imported twelve birds from California. All but two died before they became acclimated, and from these two he has raised as fine a flock of birds as there are in the United States.

At Mesa City there are thousands of acres of land on the mesa now being flooded. The roads even for miles are flooded and almost impassable. The mesa has not for years been blessed with such an abundance of water.

CALIFORNIA.

A committee appointed by the water company at Santa Ana, to report on the practice of taking water for domestic purposes and watering stock from the irrigation ditches, recommends that the watering of stock be strictly prohibited, and that for domestic purposes the water be stored in a reservoir or cistern at the time of the regular "run."

Chief Engineer Julius M. Howells, of the Consolidated Water Company, has purchased Judge Henderson's Boulder Creek ranch for $2,000. This is supposed to be a move on the part of the company toward securing power for an electric power plant which this company may build in the future to supply this city with electricity.

The Pasadena Fruit Growers' Association has shipped sixteen carloads of oranges East so far this season.

The botanist would have an interesting time counting the different species of plants growing wild along the streets of Santa Barbara, Cal. Sweet alysium, verbenas, petunias, "four-o'clocks," scarlet geraniums, etc. In the canyons near-by the mountain lilac fills the air with fragrance from its blossoms.

A large force of workmen are employed in completing the track of the Pasadena & Los Angeles electric railway from Columbia street to Pasadena and Guaranza.

The fields surrounding Pasadena are yellow with poppies, and the small boys are reaping a harvest selling them to visitors and tourists.

Green peas and other fresh garden truck now find place on the Orange county dinner tables, to the surprise and delight of the visitors from the North or East.

The fruit on exhibition at the Citrus Fair in Los Angeles is probably the finest that has ever been shown, and the present fair is a grand object lesson of the importance of the fruit growing industry to Southern California. It is hoped that some means will be found to hold such a fair every year.

The success which has attended the organization of the orange growers has stimulated other producers to act in the same direction.

The directors of the proposed San Joaquin Valley railroad are considering the best route from San Francisco to Bakersfield.

COLORADO.

A large irrigation ditch is being built in Sedgwick county, Colo., near Julesburg.

The Grand Mesa Reservoir Company, of Colorado, recently elected new officers and are preparing to have a full reservior this summer.

The Junietta Reservoir Company have resumed work, and expect to have their reservoir ready to fill during high water.

A large force of men and teams are at work upon the Mt. Lincoln ditch. Mr. J. E. Price is pushing the work, and will have the canal in good condition in time to furnish water for this season's crops.

KANSAS.

The Kansas legislature recently passed an act providing for an irrigation commission of five, to consist of the president of the State Agricultural College, chief geologist of the Kansas State University and three persons to be appointed by the governor. The three appointees are to receive $1,000 a year each and actual expenses. The governor appointed D. M. Frost, Garden City; W. B. Sutton, Russell, and M. B. Tomblin, Goodland—D. M. Frost, president; W. B. Sutton, secretary. The act carries an appropriation of $30,000 for the next biennial period, which is to be expended principally in the conduct of irrigation experiments in the arid and semi-arid districts.

The legislature also passed a law of special interest to reservoir builders, and no doubt will stimulate the farmers to put in more pumping plants. It provides, "that every owner of real estate amounting to forty acres, who shall construct and maintain for ten years upon forty acres, or upon each forty acres that he may own, a pond or reservoir of water which shall have an area of at least one acre in extent, shall for said term of ten years be entitled to a bounty therefor equal to ten per cent. of the taxes paid on said forty acres, dating in each case from the construction of such pond or reservoir, such bounty to be paid annually out of the county treasury on a warrant therefor."

An organization composed chiefly of farmers of Garfield township, Finney county, was perfected recently, and a charter applied for to build three irrigating ditches. The charter members are Wm. Moore, James Chapel, R. J. Churchill, Frank Rose, Foster Rose and Levi Wilkinson. The purpose of the company is to construct three short-line ditches.

LOUISIANA.

A conference among planters in the Donaldsonville district has been held with a view to adopting uniform wages. Some are paying fifty and others

sixty cents a day. Laborers have submitted with as good grace as possible to a reduction of from 15 to 25 per cent.

The disorganization of the sugar industry resulting from the discontinuance of bounty, is resulting in all sorts of contracts for leasing and working on shares. It is discouraging to the taking of personal risks by the large planters.

NEBRASKA.

The Lincoln *State Journal* says the legislature owes it to the State to do something for the encouragement of irrigation. There is no truth more patent to the practical observer than that the Nebraska farms, as a rule, are too large. Whenever a farmer holds a larger amount of land than he ought to own, having it encumbered for one-third or one-half its value, it is apparent that he should divide with some other farmer, and each of them hold his share free and clear of encumbrance.

At a recent farmers' institute held in Wescott many interesting papers were read, covering a variety of topics, and a resolution of thanks to the people who have assisted the Nebraska sufferers was passed.

The Cozad Irrigation Company have resumed work on their canal and will push construction rapidly. Mr. A. P. Kittel, of North Platte, is the engineer, and he will complete the survey at once.

Farmers along Frenchman Creek, near Kearney, are taking out individual irrigating ditches.

Some of the scenes connected with the distribution of donated supplies have been far from edifying, and yet pathetic. The complications which have arisen through a partial provision for State aid, and the conflict of authority between official and volunteer committees have delayed the delivery, in many cases, until serious losses have occurred. Perishable articles, like potatoes, etc., have been rendered almost worthless. It is an unfortunate condition of affairs.

NORTH DAKOTA.

Irrigation is being much talked about in North Dakota, and many farmers are taking hold of it in a practical way. The windmill and water-power pump will be factors of vast importance in the future economy of the State.

UTAH.

The Utah Sugar Company has secured contracts for 3,400 acres of sugar beets, and have closed their books. This is as large a quantity as the Lehi factory can take care of. The contracts were made on a basis of $4 per ton.

Construction has been commenced on the Mt. Nebo Reservoir and Canal in Utah and Juab counties, Utah, south of Utah Lake. It has taken some two years to secure the lands which will be overflowed and the rights of way through improved lands, and a considerable expenditure. It is to utilize the waters of Current Creek, and will irrigate from 25,000 to 30,000 acres of land in the fork between the Rio Grande Western and Union Pacific railways. A reservoir six miles long and a mile wide, with a capacity of a billion cubic feet, is a feature of the system. The policy is to divide it into small farms, and give special attention to the cultivation of fruit and sugar beets. The cost is to be about $150,000, and it is said the capital has already been secured.

A potato starch factory is being constructed at Mt. Pleasant.

WASHINGTON.

The Latah Beet Sugar Company has been organized at Spokane with D. T. Ham as president; capital stock, $300,000. The work of laying the foundation for a beet sugar factory at Latah is already under way. The people have donated a site of fifty acres.

About eighty acres of land in the Sunnyside district will be planted to sorghum cane this spring. It was found a very profitable crop last year.

A plucky woman, Mrs. Alice Houghton, has been making earnest efforts to secure an exhibit of the State productions of Washington for display in Chicago. She failed to get individual recognition, so made application at the State capitol, and secured from the legislature a small appropriation for that purpose. It is that sort of work that will make times improve.

WYOMING.

The State senate made formal inquiry of State Engineer Mead as to the unused appropriations of water within the State. He says: "In reply to the inquiry as to the amount of unused appropriated water, it is impossible to state specifically whether or not each appropriation is being fully used, but it is believed the greater number of the appropriations determined and established are being used in good faith. While your inquiry does not ask for the information, it may be stated that seventy-five per cent. of the water is both unappropriated and unused. There is not even a claim against two of the largest streams in the State. The unappropriated water which ran to waste in another of our largest streams last year in a single day would irrigate 50,000 acres of land. While some of the smaller streams of the State are fully appropriated or over-appropriated, there is a large surplus in each of the more important ones."

State Engineer Mead and State Treasurer Hay were in Douglas recently inspecting the proposed routes and plans of the Douglas Light and Power Company plant.

CANADA.

Municipilization of public service is being carried forward rapidly in Canada. A bill is pending before the Dominion Parliament authorizing the city of Toronto to establish a Fire Bureau under the control of the three commissions. The bureau will have entire charge of the fire department, and will also conduct a regular insurance business, requiring all property to be insured, and collecting the premiums in the form of additional taxes. Old insurance will remain in effect for a short time, but when the present policies expire the compulsory municipal insurance becomes operative.

THE NEW BOOK.

Coin's Financial School continues to attract wide attention. It is written in an entertaining style that does not fail to interest and instruct. It goes to the very root of the idea of bimetallism, and readily demonstrates that free coinage of silver is the remedy for existing monetary conditions.

PUBLISHERS' DEPARTMENT.

ADVERTISING UTAH.

FOR several months the Bear River Irrigation Company, having its headquarters at Corinne, Utah, has been advertising extensively through the columns of the Chicago *Inter Ocean*. The policy adopted by Mr. Rowe, its energetic and enterprising president, seems to be the constant repetition of the advantages of the undertaking, and as to the opportunities offered to the same set of readers, until they shall have become thoroughly familiar with every feature of it. Use is made of both daily and weekly editions of the paper, thereby taking advantage of its very large circulation, and he seeks to reach the better class of farmers in the Central and Northwestern States, where it so generally circulates.

The style of advertising is noticeable, the central idea being to present every feature of the country, and to make the propositions regarding it entirely clear and plaid. Even the display ads., which appear in both single and double column, are instructive and constantly changing. They are made as attractive and interesting as the "reading matter"—even more so, as the ingenuity and skill of the compositor give emphasis to the striking features.

It is being conducted in no narrow spirit, but every line of it tells for Utah and the inter-mountain country, showing the advantages of a residence there, and identifying all classes of the population at home in a general interest for the public good. The company is fortunate in having one of the finest bodies of land in all the country to dispose of; land which will never disappoint the purchaser, and taking the country as a whole, there is abundant opportunity to choose. Its soil is the accumulation of centuries from the sedimentary deposits of a large river, its delta. It was formerly at the bottom of a vast lake—as large as Lake Huron—known as Lake Bonneville, which covered the particular part of the valley now being settled to a depth of more than 800 feet. It is deep and rich, abounding in vegetable deposits and yields bountifully to intelligent cultivation.

Mr. Rowe reports the result of advertising to be far beyond his expectations. Inquiries are pouring in by thousands, and the wide-spread influence is becoming generally apparent. Even at home the effect is quite as noticeable as abroad. The old adage that a prophet is not without honor save in his own country, finds counterpart in the better appreciation of the same thing said abroad, which at home would be taken as a matter of course, and scarcely receive a passing notice. Not only are settlers arriving on the ground in goodly numbers, but many sales are being made to a superior class of people. Passengers going through over the Transcontinental begin to inquire as soon as they strike the Territory, "Where is the Bear River Valley?" It is rarely that a man examines these lands without making a purchase, if he is seeking a home.

There is an advantage in this section, too, in the object lessons, which abound on every hand, of successful cultivation and home making. Nowhere are these lessons so impressive as in Utah. Little farms and comfortable homes abound everywhere, and the general average of prosperity among the farming class is exceptionally high.

As fruit lands there are none superior anywhere. All kinds of deciduous fruits thrive there, and it is especially the home of the apple and pear—the big, high-colored, luscious fruit. It is destined to become one of the great fruit districts, as it lies immediately on the line of the Transcontinental railways, with every facility for reaching the market quickly, and a day and a half or two days nearer than any part of California.

MILLION FOR A "CURE."

Druggist Schrage Sells a Secret Compound to a Syndicate.

IT IS A REMEDY FOR RHEUMATISM THAT HE HAS BEEN WORKING ON FOR YEARS AND NOW HAS BROUGHT TO A STATE OF PERFECTION.

Frank Schrage, a North Clark street druggist and discoverer of what he claims is an infallible specific for rheumatism, sold the exclusive agency for his remedy yesterday to a syndicate of Chicago people for a large bonus and a large royalty. It was reported that the bonus was $1,000,000.

Mr. Schrage, however, declines to tell how much he received. He said to a reporter of the *Tribune:* "A syndicate of Chicago men has paid me a large bonus, and agreed to pay me a large royalty for the exclusive agency, but how much they have paid me, or will pay me, or who they are, I will not tell. I certainly expect to make more than $1,000,000 out of it before I get through with it. I perfected my discovery three years ago, and have been selling it for two years. It is not patented, but I defy any analytical chemist to tell what is in it. I have deposited the formula in a safe-deposit box, to which I have one key, and my wife another, so that the secret will not be lost if I should die."

The mixture is a dark-brown fluid having the taste of sarsaparilla and wintergreen, which, however, were used simply to disguise the taste of the essential components. Mr. Schrage said it was an infallible specific for rheumatism, even of long standing and in old people, whether in the bones or muscles. It had never been advertised except by giving a bottle occasionally to prominent people afflicted with the rheumatism. One of the syndicate has started for Europe to introduce the remedy there.

Although the discovery was made two years ago or more, Mr. Schrage did not seek much publicity in the matter. He modestly made his discovery known to several German professors and to a few of his customers at his drug store, and remarkable cures, it is claimed, were the result. The discovery in time became known to many physicians in Germany, New York and elsewhere, as well as in Chicago, and investigations of the discovery were made by men across the water, who sent for the mixture. The experiments made were successful, for a syndicate was formed, and the contract closed one day last week. Chemists have analyzed the discovery, which is in liquid form, but have not been able to discover the exact contents of the preparation.

D. B. Lyman, president of the Title and Trust Company, is the lawyer who closed the deal for the syndicate which purchased the right to use the discovery, and C. F. Loesch, attorney for the Pennsylvania Railroad, acted for Mr. Schrage. David B. Lyman was seen yesterday with reference to the deal, and acknowledged his connection with it as the legal representative of the syndicate. He refused, however, to discuss details, and when inquiries were made regarding them, replied that he was a lawyer of the old school, and would not make public that which had been intrusted to him. The matter, he thought, was one which in no wise concerned the public at large.

C. F. Loesch was also seen regarding the transaction, and he likewise declined to have anything to say relative to the terms of the contract. When told that it was represented that Mr. Schrage would realize $1,000,000 by his discovery inside of ten years, the lawyer looked surprised, and said that in his opinion there was much more in it for his client than the amount named, and that he fully expected to see the latter a millionaire inside of five years.—*Chicago Tribune.*

It is learned that the company referred to is Swanson Rheumatic Cure Company, of Nos. 167 and 169 Dearborn street, Chicago.—*St. Louis Republican.*

HOMES IN THE LAND OF SUNSHINE.

PLEASURE AND PROFIT IN CULTIVATING CANAIGRE IN THE VALLEY OF THE RIO PUERCO.

DEEP down in the heart of every man is a spark of the love of mother earth, which needs but to be fanned to burst into a glowing flame. When mere earth is supplemented with a fine climate and the beautiful aspect of snow-capped mountains and peaceful valleys, it becomes not only a profit but a pleasure to be a "tiller of the soil," and master of one's own domain. New Mexico has aptly been termed the "Land of Sunshine"—the land of massive mountains and quiet valleys, of rushing rivers and babbling streams. Among its many fine valleys may be mentioned the valley of the Rio Puerco. Here is a valley containing four hundred thousand acres of land, with soil of surpassing fertility and great depth, watered by the "Muddy" river, the sediment of which but increases the fertility of the soil when it is applied by irrigation. In this valley can be grown to perfection, not only grain and vegetables, but nearly all the deciduous fruits, and owing to the nearness to market, a large profit can be realized from the sale of them. There is, however, one other product which, needing but little cultivation, promises to become a crop of great importance, leading to its being planted upon thousands of acres, and leading eventually to the establishment of extract factories, thus giving employment to numbers of men and increasing the general prosperity.

The plant referred to is called canaigre. It is a plant bearing quite a resemblance to some of the more common docks, notably sour dock, and grows from one to three feet high.

The roots or tubers of the canaigre plant have the general appearance of sweet potatoes, there being from three to one dozen to each plant, varying from two to eighteen ounces each in weight. The color is black externally and yellow within, having somewhat the appearance of a carrot. The taste is insipid, but something of the same sensation is produced when touched to the tongue that follows from alum, indicating the presence of tannic acid.

This plant has but recently attracted the attention of the commercial world as a valuable source of tannic acid. Numerous analyses have been made by the government agricultural departments, both in Europe and America, as well as by private scientists, all of which tend to show its great value to the leather industry. The result of these investigations has been to create a great demand for it in the tanning business of European countries, and more recently in the leather-making industries of the United States.

It is found that the tubers of one year old, when dried, contain from 23 to 38 per cent. tannic acid, and canaigre is already recognized by tanners as being superior to oak or hemlock bark, in that it tans quicker, is a better filler, and makes a more pliable and better colored leather than any tanning agent known.

As to the tanning value of canaigre, Prof. W. Eitner, of the Vienna Research Station for Leather Industry, after thoroughly testing it, said: "I consider this article especially adapted to tanning uppers, fine saddlery and fancy goods." Canaigre will also doubtless enter largely into the arts and industries other than leather making. In the manufacture of dye stuffs and mordants it is said to be very valuable, and we may confidently entertain high hopes of it as an important article in American agriculture in the immediate future.

In describing the methods of its cultivation we can do no better than quote from Prof. F. A. Gulley, of the Arizona Experimental Station, who says: "The roots make the best development in a rather loose, sandy soil, and where they are near the surface. Planting should be done early in the fall, not later than November 1st, if possible, and occasional irrigations given it until the latter part of April, or up to the time the plant is in bloom. Irrigation may then cease and the roots be allowed to mature. With comparatively clean soil very little labor is required. It has furthermore been demonstrated by practical experiments that cultivation adds very largely to the quality and weight of the roots and the percentage of tannic acid."

It will be noticed from the above that planting is done in the fall and the work upon it therefore performed during the winter when other crops do not need attention. The root matures about July 1st, and is ready for digging. In some climates, notably New Mexico, another crop can be raised on the same land after the canaigre has been removed, making two crops in one year.

One ton of the root is required for seed to plant an acre of ground. In New Mexico there are large quantities growing wild on the hillsides and in the depressions that can be had for the digging, and all the expense attached to the securing of it is the cost of digging and hauling it to the land where it is to be planted. The supply of wild product, however, is being rapidly exhausted on account of the great quantities used for seed. When the wild root is used up, that which is cultivated will have to be used, which will cost about $6 per ton.

Careful estimates show that an acre of canaigre properly cultivated will yield from ten to twenty tons of green roots and as high as thirty tons have been raised on a single acre.

Prices in Europe have been $60 to $80 per ton of dried root, and in the United States about $30. Estimating the cost of marketing, freight charges, etc., to be $10 per ton (of the dried root), and figuring the lowest yield and price it will be seen that an acre of canaigre would bring about $100.

The Western Homestead & Irrigation Company own a tract of land in the Rio Puerco valley, containing 49,727 acres, known as the Bernabe M. Montano Grant. About 30,000 acres of this land can be irrigated, and is platted in ten acre lots. This land, with a complete system of irrigation and an abundant supply of water guaranteed, is offered at the low rate of $50 per acre on easy terms.

For further particulars apply to

WESTERN HOMESTEAD & IRRIGATION CO.

612-613 Bort Bldg., 21 Quincy Street, Chicago.

EVIDENCE OF EYE WITNESSES.

A CHICAGO DOCTOR BUYS LAND.

CHICAGO, February 13, 1895.

MESSRS. M. P. BORDEN & CO.

Gentlemen: Replying to your recent favor, I would say, that last year I went to Southern California and made a personal investigation of a large number of land propositions, particularly throughout the famous San Gabriel valley. I did not at that time have the opportunity to visit Hemet, although I heard it spoken of very favorably indeed. A few days after you opened the Chicago office, in December, for the Hemet Land Company and the Lake Hemet Water Company, you will recollect, I called upon you, was shown photographs of the substantial improvements at Hemet, and had a long discussion with you regarding your location, your soil and your water supply. I desire to state now that, unbeknown to you, I had my father, who is now in California, and who is, by the way, a practical farmer, go to Hemet, make very thorough investigation and report to me. I am now in receipt of samples of the soil taken from different parts of the Hemet tract, which I have subjected to a chemical analysis. I find, after a rigid examination and comparison with forty other varieties of Southern California soil, that it is of almost inexhaustible richness, and particularly adapted to the cultivation of fruit. In brief, I find it equal to all, and vastly superior to most, of the soils examined, with two exceptions, and in those two instances the water supply of the lands was inadequate and uncertain, and could not, therefore, be considered.

Our investigations led us to a number of other localities, but the conclusion reached was "that Hemet was head and shoulders above them all."

I write this letter because I feel that, as these investigations were made without your knowledge, proper credit should be given you for the excellence of your proposition.

I have wired my father to make the selection of our land, and hope to have same planted this season. Wishing you success in your enterprise,

Very sincerely yours,

(Signed) ELMER E. BABCOCK, M.D.,
3239 Indiana avenue.

P. S.—I should have stated that Mr. H. H. Amidon, of Peoria, who accompanied my father to Hemet, has purchased land and will make Hemet his home.

NOTE.—Dr. Babcock has purchased and planted fifteen acres since above was written.

FRUIT AND ALFALFA.

HEMET, CAL., December 4, 1894.

MESSRS. M. P. BORDEN & CO.

In regard to my little experience and success of farming in the San Jacinto valley of California; I have twenty acres; ten of it is set to fruit, ten sown to alfalfa. My fruit trees have brought me in light returns as yet; they are too young to bear much fruit. Disposed of several tons of green fruit at a fair price for this season.

My trees have made a vigorous growth, and I expect a large yield next season.

From what I have seen of other orchards similar to mine, I expect an income next year of $100 per acre, and an increase per acre for several years till the trees are done growing.

I have cut six crops of alfalfa that will average one and a half tons per acre each cutting, or ninety tons for the season on the ten-acre lot. I have disposed of all of my hay at an average of $10 per ton. This is the second season for my alfalfa.

Yours truly, F. O. LEE.

A BAPTIST MINISTER'S VIEWS.

HEMET, CAL., February 7, 1895.

S. H. BLOOM, Adv. Mgr. *Baptist Union.*

Dear Sir: Yours of January 31st, inquiring concerning the Hemet Land Company, of which Mr. W. F. Whittier is president and Col. E. L. Mayberry vice-president, is received. The company undoubtedly has *large* capital, ample for all their land company and water company business here. They have a large tract of land for sale. The land, I think, is excellent, finely situated, with good soil. In my judgment the climate is as good as any I have seen in Southern California. Of course, I do not profess to be fully informed as to the details of the title of the land, or of the financial ability of the company, but I have lived here about five months, and the company is here believed to have almost unlimited capital. The company is pushing things by way of improvements, both in the town of Hemet and also in the valley, in planting trees, sowing grain, etc. I am at present living in one of Mr. Whittier's cottages in Hemet. There has been great improvement both in Hemet and in the sourrounding country in the five months I have lived here. The Baptist church, of which I am pastor, is the only church which has a house of worship here, and that is making good and rapid growth. I would like to see Baptists settle here.

(Signed) J. H. SAMPSON.

CHEAPEST WATER RIGHT.

CHICAGO, March 5, 1895.

MESSRS. M. P. BORDEN & Co., Chicago, Ill.

Gentlemen: In the winter of 1893–'94 I made a trip to California to see what was there in the shape of land. During my trip I visited nearly all of the old and new places where fruit land was advertised for sale, and in my wanderings visited Hemet. I found there, in my opinion, the best land, considering all things, that I saw anywhere. There land is of a rich soil, being very smooth, and needs no grading or clearing. As to their water right, they have the best and cheapest that I saw, without exception. It is owned and controlled by a company of undoubted standing, and the purchaser of land can be assured of a constant and unfailing supply of water, and cheaper than any place I saw.

I visited Whittier, Pomona, Ontario, Riverside, Glendora, Escondido, Moreno, Lake View, Peris and several other places around Los Angeles.

Yours truly, J. C. AUSTIN.

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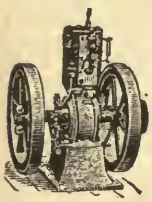
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THE IRRIGATION AGE.

VOL. VIII. CHICAGO, MAY, 1895. No. 5.

THE PROGRESS OF WESTERN AMERICA.

The Suicide of Paul Schulze. The suicide of Paul Schulze, of Tacoma, the prime mover in the large irrigation enterprise known as the Sunnyside system in the Yakima valley of Washington, may properly be construed as having a deep significance in connection with the irrigation industry. Mr. Schulze was a man of large and daring enterprise, who felt a genuine enthusiasm for the West in general, and for magnificent Washington in particular. Viewed simply as the ending of a life which had been conspicuously identified with the growth of a State, and which had been notable for its public spirit, the tragic death of Mr. Schulze seems infinitely sad. But as Daniel Webster once said, in the course of a famous trial for murder: "Suicide is confession—always, always." The world now knows that this enterprising man was a defaulter. This knowledge comes like a shock to his friends, but the incident will soon be forgotten in the busy rush of life. Mr. Schulze's suicide is a confession in another sense which interests the public much more nearly and keenly, and this part of the confession we have no right to pass over lightly, because a valuable lesson may be drawn from it. It is important to the people of this country that this lesson should be learned, and in no spirit of unkindness to the memory of Paul Schulze, of whom many good things have justly been said, we desire to lay stress upon this teaching of his life and death.

A Valuable Lesson Taught. Paul Schulze was a type of the enterprising men who come out from foreign countries and Eastern States and set deliberately at work to obtain control of natural opportunities, and to levy preposterous tribute upon the industry of men who earn their bread in the sweat of their faces. In this respect he stood as the representative of a system under which the development of the West has largely gone forward. His suicide is a confession that avarice is not always profitable, and that greed may sometimes set its mark too high. In all Arid America there is no fairer spot than the beautiful valley of the Yakima. Nature designed it to be the home of an extremely prosperous people. The soil is kindly, the climate genial, and the country



REV. DR. JOHN RUSK,
Of the Homeseekers' Association.

is watered by an unfailing stream of noble proportions. Here are the raw materials of prosperity, waiting only for human industry to bring it into being. And yet, although millions of good men and women are hungry for just such opportunities as the Yakima valley has offered from the day that Mr. Schulze's canal system was added to its natural advantages, the people did not flow in fast enough to save this man from financial ruin and death. It was not the fault of the valley, nor of the people. It was the fault of the individual who set a practically prohibitory price upon those lands, and who barred the people out almost as effectually as if he had erected a Chinese wall about the valley and surmounted it with gatling guns. There are few places where, with

proper economy and wise administration, land can be reclaimed or settled more cheaply than in this locality. The average cost of reclamation, according to the census of 1890, was $8.15 per acre. We believe this system cost more, though it had no business to cost more. But no one claims that the price of $55 per acre, which has been asked for this land, would not represent a profit of from 100 to 200 per cent. upon the actual investment. It probably represents a profit of more than 500 per cent. upon what the cost of reclamation ought to have been. And it proposed to supplement even these exorbitant profits with a perpetual rental, so that after the entire investment has been taken out, over and over again, the settlers shall pay eternal interest upon no capital whatever.

Private Avarice or Public Good? This is the spirit in which railroads and other enterprises have been developed in the West. The thing is not done for the benefit of those who make the actual investment in bonds. It is done for the benefit of those who promote enterprises and who invest only their wits. The worst feature of this system is the fact that these unreasonable profits are to be wrung from the toil and sweat of men who make their homes in the virgin wilderness, and who must coin their living from the soil. And this aspect of the matter is made worse by the fact that the lands in question were but recently the property of the nation, open to entry by any citizen, and that under this system the promoter is speculating in public assets. If Mr. Schulze had been satisfied with a reasonable profit, of say fifteen or twenty per cent. upon the actual investment, his lands would have been quickly settled, he would have been alive and prosperous to-day, and would have gone down in the history of Washington as a benefactor, instead of as a suicide and defaulter. How long must the people hunger for lands; how long must irrigation enterprises wallow in bankruptcy; how long must the great West wait vainly for settlers to till her soil and raise the superstructure of a great civilization, before the lesson of this suicide's confession of failure shall be learned?

Schulze's Influence on Legislation. When the National Irrigation Committee opened correspondence with the leading public men of Western States, just previous to the assembling of recent legislatures, word came from Washington that the magnificent donation of 1,000,000 acres could not be accepted in that State unless a price of $100 per acre were set upon lands within two miles of towns, and a price of $50 per acre upon lands beyond the two-mile limit. Members of the National Committee promptly replied that the idea was preposterous; that the object of the movement was not to reclaim more lands which should be beyond the reach of the people, but o reclaim lands which they could obtain; that the Carey law offered an opportunity to furnish homes for those most in need of homes; that legislation ought to be enacted which would open these lands at prices which bore a fair relation to the cost of reclamation. It was not expected that capital could be obtained without good security, or without paying a reasonable profit in the shape of interest for the use of the money and commissions to those who negotiate sales of securities. The National Committee was again advised that Paul Schulze and his friends had sufficient influence in the legislature of Washington to put such provisions in the bill. And when the bill was passed it was found that the maximum price of these public lands had been fixed at $50 per acre. Montana fixed the maximum price for land and water at $8 per acre, while Idaho, Wyoming and Colorado left the matter to be settled by their public land boards, but the spirit of their legislation was wholly in line with the demands of the National Committee. Washington will soon learn that if she is to obtain any benefit from the Carey law she must defeat the men who put this ridiculous provision into their legislation and meet the competition of other States. The time has come when our Western people should realize that their higher interest is to obtain population, and to give that population a chance to live and to prosper. The real investors neither expect nor receive profits of 500 per cent. They are satisfied with good security and six per cent. or seven per cent. Certainly the experience of Paul Schulze proves that the old method is not profitable, either to the promoter or to the country. Now let the Western States open their lands on terms that the homeseeker can meet and observe what effect that policy has upon their development. The writer has been coming in contact with all sorts and conditions of people during the past few months. To him it seems perfectly plain that a mighty tide of population can be rolled into our arid States, and that institutions can be developed which will make these people independent landed proprietors. But people are not going to struggle to get away from landlords in order to put themselves under waterlords. They demand a chance to utilize the public waters and the public lands without paying unreasonable tribute to individuals. To devise means by which this can be done is the problem for Western statesmanship. And it can be quickly solved the moment our people make up their minds that they will not permit private avarice to stand in the way of public good.

The Cabinet Recognizes Irrigation. The splendid advance of the irrigation cause in popular interest and esteem has stirred the official life of Washington and led to unexpected and gratifying action. How much is due to the public notice the movement has attracted, and how much to the persistent effort of certain good friends of irrigation in

the Executive Departments, we do not know, but the action taken is most intelligent and significant, and not the least pleasing feature of it is the fact that it gains its standing from the active support of two



F. H. NEWELL,
Of the United States Geological Survey.

members of the Cabinet who have been regarded heretofore as indifferent or unfriendly to Western development. Hon. Hoke Smith, Secretary of the Interior, has been more conspicuously identified with the promotion of Southern emigration than with the encouragement of Western progress during his term of office. Hon. J. Sterling Morton, Secretary of Agriculture, has officially discouraged the work of reclamation and settlement, and taken the ground that the country is already over-producing the necessities of life. We recall these circumstances not to be ungracious, but because a knowledge of them is essential to a full appreciation of the importance of their present action. They have countenanced the creation of a joint association, consisting of officials named by them from their respective departments, organized for the purpose of assisting in every legitimate way the development of irrigation plans and policies. The practical benefit that may result from this action of Secretaries Smith and Morton is large; the moral effect of it upon public opinion and congressional action may prove enormous. These members of the Cabinet, as well as the subordinate officials who have encouraged, if not suggested, the step, and who will take up the work as an added burden without added compensation, are entitled to the hearty thanks of Western people and of the army of sympathizers now rapidly growing throughout the country.

Personnel of the Board of Irrigation. The name of the new official body is "The Board of Irrigation, Executive Departments." It has organized with Prof. Mark W. Harrington, of the Weather Bureau, as chairman, and Prof. F. H. Newell, of the Geological Survey, as secretary. A study of its personnel reveals its possibilities of usefulness. Charles D. Walcott, director of the Geological Survey, has in charge the investigation of the extent to which the arid land can be redeemed by irrigation, as well as the topographic survey of the country, the selection of reservoir sites, and other surveying operations. Mark W. Harrington, as chief of the Weather Bureau, has general oversight of the collection of information pertaining to rain and snowfall, its distribution, and the aridity and other climatic details. Daniel M. Browning, Commissioner of Indian affairs, is authorized by Congress to introduce methods of agriculture by irrigation among certain Indian tribes, to construct canals and ditches, and to bore wells. Edward A. Bowers, assistant commissioner of the General Land Office, has,



CHAS. W. IRISH
Member Board of Irrigation, Executive Departments.

in connection with his official duties, the rendering of decisions respecting rights of way for canals and reservoirs on the public lands and the administration of the laws relative to acquisition of titles under the

desert land and similar acts. Charles W. Irish, chief of the Office of Irrigation Inquiry of the Department of Agriculture, is continuing the collection of information as to the best modes of agriculture by irrigation, and is giving information by letter to individual farmers of the country as to methods of constructing small reservoirs, ditches, and other means of procuring water. F. H. Newell, the secretary of the board, is in charge of the hydrographic work of the United States Geological Survey, is measuring the streams and ascertaining the water supply, and has in preparation or already in print a number of reports relating to the general subject of irrigation and of the quantity and fluctuations of important streams. Milton Whitney, chief of the Division of Agricultural Soils of the Department of Agriculture, has been investigating the relation of soils and water, the behavior and moisture in various kinds of soils, and obtaining information of fundamental importance to the farmer. Henry Gannett, chief topographer of the United States Geological Survey, has for twenty years or more been making surveys in the West; has explored many of the rivers of that region, and has written upon the agricultural value of many districts. He now has general supervision of the topographic surveys, including the selection of reservoir sites. B. E. Fernow, chief of the forestry division of the Department of Agriculture, is collecting information as to the relation of forests to moisture and to protection of crops, showing the dependence of irrigators upon proper preservation and utilization of forest areas. B. T. Galloway, chief of the division of vegetable physiology of the Department of Agriculture, though coming last, has in charge an investigation of great value, since it concerns the actual behavior of plants in respect to their supply of water.

The Line of Work to be Done.

The Board of Irrigation has adopted a constitution and a resolution which indicate the general trend and scope of its work. After consultation with prominent Western men, the board will also coöperate with the various States in encouraging development under the Carey law. The constitution adopted is brief and is reproduced here, as a matter of great interest to readers of THE IRRIGATION AGE:

Article I. Name. This association shall be known as "Board of Irrigation, Executive Departments."

Article II. Objects. Its objects are the correlation of the several lines of distinct yet related work for irrigation carried on by different departments of the Government, and the discussion and rendering of opinions upon such matters pertaining to irrigation as may be brought before the Board.

Article III. Membership. The Board shall consist of the Director of the Geological Survey, the Chief of the Weather Bureau, the Commissioner of Indian Affairs, the Assistant Commissioner



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F. D. Coburn

Secretary Kansas Department of Agriculture, and Secretary and Treasurer Kansas Irrigation Commission.

of the General Land Office, the Chief of the Office of Irrigation Inquiry of the Department of Agriculture, the Chief of the Hydrographic Division of the Geological Survey, the Chief of the Division of Agricultural Soils of the Department of Agriculture, the Chief Topographer of the United States Geological Survey, the Chief of the Forestry Division of the Department of Agriculture, the Chief of the Division of Vegetable Pathology of the Department of Agriculture; and such other persons concerned with irrigation in any of the Departments as may be appointed by the Secretary of that Department upon recommendation by this Board.

Article IV. Substitutes. Any of the above named members may delegate one of his assistants to act as his substitute at a meeting of the Board.

Article V. Officers. The officers of the Board shall consist of a Chairman and a Secretary, each of whom shall be elected at the first meeting after this constitution is approved by the Secretary of the Interior and the Secretary of Agriculture. These officers shall serve one year, or until their successors are elected.

Article VI. Meetings. Regular meetings shall be held on the first Wednesday of each month from November to April, inclusive. Special meetings may be called at any time by the Chairman of the Board, or, in his absence, by the Secretary or in the absence of both, by a call signed by three members.

The following resolution, adopted April 3, is also important as showing the scope and functions of the Board:

The functions of this Board being advisory as regards the interpretation and execution of Federal laws concerning irrigation, and also as to the co-operation and specialization of work in various bureaus, it is resolved that the Board shall, as its first business, prepare brief statements of the following:

a. Existing legislation relative to irrigation.

b. The work hitherto done by the various divisions, whether published or unpublished.

c. The lines and methods proposed to be pursued by each division for the future.

d. The deficiencies and difficulties experienced which might be remedied by co-operative action.

After such statement has been prepared, the Board shall then agree as to the principles of subdivision of the work, as far as the law allows latitude, and as to principles of co-operation.

The Board shall then, with the guidance of these principles consider questions of desirability and expediency of conducting and extending work in each bureau, and practicable methods of doing so, together with such matters as may be sent to the Board by heads of departments for expression of opinion.

What Kansas Has Done.

The fight for irrigation in Kansas has at last borne substantial fruit in the way of legislation, and a new chapter in the history of the Sunflower State may fairly be said to have begun. The new law provides for a State Board of Irrigation, consisting of five members, two of whom are the Geologist of the State University at Lawrence and the President of the Agricultural College at Manhattan. The others are named by the Governor, and the president of the board is to be

known as the State Irrigation Engineer. The board is charged with the following work:

1. To construct twenty irrigation well and pumping stations in as many different counties, as a practical test of the possibilities of irrigation from underground waters.

2. To ascertain the amount of surface waters in streams flowing west of the 98th meridian, and the practicability of storing such waters for irrigation purposes.

3. To provide a full and complete drainage map of Western Kansas.

4. To obtain data of rainfall, evaporation, temperature and soil percolation.

5. To make test drillings for artesian basins and report upon the chances for storing waters that may be so obtained.

It is also provided that full reports of these various operations shall be made and filed with the State. The total appropriation for this work is $30,000. The sum seems ridiculously inadequate to the demands of a State which has lost more than $30,000 a week in the matter of reputation alone, not to mention the millions lost in damaged crops, nor the human misery incurred by repeated drouths. But the law is a good one, and the appropriation is a great deal better than nothing. It is to be hoped that the next legislature will be so well pleased with the result as to provide more generously for future work. The new board has made an excellent start by selecting H. V. Hinckley as its consulting engineer. He has the brains, training and enthusiasm to perform a splendid public work in that capacity.

Nebraska also Takes Action.

In Nebraska, too, the movement has triumphed in legislation. One section of the new law reads: "Water is hereby declared to be a natural want." This simple declaration means a great deal to Nebraska, both in a legal and in a sentimental sense. It is the final recognition, so long delayed by indifference and stupid opposition, but so imperiously and persistently urged by recurring seasons of drouth, that Nebraska is a State that requires irrigation. The declaration puts the need of water for irrigation on the same basis as the need of water for domestic purposes, and thus makes appropriation for this use superior to appropriation for power, or any other use, except the vital necessities of sustaining life and producing crops. The new law also creates the office of State Engineer, and an Irrigation Board, consisting of the Governor, Attorney-General and Land Commissioners. The State is divided into two great districts of the North and the South. Nebraska is better watered than Kansas, and there is not the same need of investigating underground supplies. Another feature of the Nebraska legislation relating to the District law is discussed further on in these columns.

The New Day in the Semi-Arid Regions.

The faithful friends of Western progress have many reasons to rejoice this year, but of all the encouraging events which are making 1895 a red-letter year to them none of them is more important than the dawn of reason upon the public men of Kansas and Nebraska. It is now five years since a small, but earnest, minority in the latter State appealed to the legislature to stop the drouth and suffering which constantly recur in western counties by ascertaining what portion of the State could be reclaimed and then proceeding to reclaim it. It is probably longer than that since a few brave spirits, then denounced as cranks, made a similar appeal to the legislature in Kansas. At last victory has come, and these two States, to rescue whose starving settlers the hat has so often been passed in Eastern audiences, are about to enter upon a policy of systematic irrigation, with a proper plan of administration, and under laws that render scientific developm nt easy and certain. There never will be a backward step there now, we predict. The constant growth will be in the direction of small farms, intense cultivation, diversified crops, better homes, nearer neighbors, higher institutions. All these things are the legitimate out-growth of irrigation. We hope the day is near at hand when it can truthfully be said that not a single farmer's family is suffering for life's necessities in either of these two States, whatever the shortcomings of the rainfall.

District Law Goes Marching On.

Although the events of the past two years in California have not been particularly encouraging to the friends of the District Law, the vital principle of the statute continues to grow in favor throughout the country. During the past winter three States adopted the Wright law with slight amendment. These were Oregon, Idaho and Nebraska. Furthermore, all the States which have accepted the grant of lands under the Carey law have provided that the ownership of canals shall finally pass to the people. It is thus perfectly clear that all the tendencies of our development are now strongly in favor of the public ownership of works, and the absolute denial of private property in water, and its corollary, the right to charge a perpetual rental. But there is a vital difference between the methods of the Wright law and of the new legislation in Wyoming, for instance. Under the former the settlers must raise capital by selling bonds and must construct the works as well as administer them when completed. It is in the sale of bonds and building of canals that the California districts have been disappointed. In Wyoming private enterprise will raise the capital and build the

works, the State fixing the maximum price of water rights. When these have been paid for, the settlers will own and conduct the works, but this cannot occur until the land is substantially settled. The two meth-



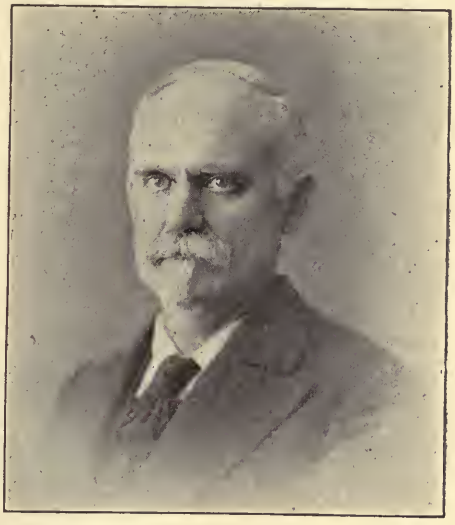
D. M. FROST,
President Kansas Irrigation Board.

ods come to the same result in the end, but it would seem that the Wyoming plan ought to avoid the pitfalls which have been encountered in California. If the decision of the United States Supreme Court should prove favorable to the Wright law, the market will probably open to the sale of District securities. Then, if people will study the California experiences and avoid the mistakes that have occurred in several instances, and, above all, if they will elect honest and capable business men to directorships, it ought to be possible to utilize the new district legislation to advantage.

Cause of the Riverside Failure. One of the worst blows that irrigation bonds have received in a long time was the failure of the Riverside Water Company, of California, last January. This failure was construed to the injury of both private and public securities. Riverside is nearly twenty-five years old; its lands are completely settled and very highly improved; it is constantly cited as the most striking instance of the prosperity of the irrigation industry. In the face of the failure of such an enterprise it would seem rather difficult to make a respectable argument for the securities of a new company. So many inquiries about this matter have been addressed to THE AGE that it seems altogether best to publish the following letter from Mr. George Frost, formerly president, and now receiver, of the Riverside Water Company:

I do not think the fact that this company has been unable to negotiate its securities, and from that cause has been unable to meet its floating indebtedness as it matured, and which everyone in these times of financial stringency has demanded, is any argument against irrigation bonds.

The primary cause of the financial embarrasment of this company is, in my opinion, to be found in the pernicious habit of people spending money before they have it; or, in other words, in improving the system upon a floating indebtedness at high rates of interest, instead of having placed its bonds at reasonable rates of interest, and with a definite time of payment before expenditure was made. When money became scarce, persons holding our obligations required money. The very reason they required it was a good reason why we could not sell our bonds, and the result was inevitable. It is true that the lands under the system are valuable; but that lends no value to the water stock, because the lands are in no way liable for the indebtedness of the Water Company, at least for any indebtedness made previous to three years; and the fact that the water is appurtenant to the land and cannot follow the stock in case of a sale, causes no alarm to the water user in case of an assessment and sale of this stock. This, instead of being an argument against the sale of District bonds, is one of the best to be advanced in their favor; that is, the *lands* of the district are bonded for the payment of the bonds as well as the water system, while in our case the system and the property of the company only are bonded. I think the Riverside Water Company will be enabled to arrange its affairs and get out of the hands of a receiver within a few months; at least it is to be hoped that such will be the case, since its plant and income are sufficient to guarantee such an event in reasonable time.



J. S. EMERY,
Director Agricultural Experiment Station, Bozeman, Montana.

The Bear Valley Outcome. It is nearly eighteen months since the Bear Valley Irrigation Company of California, went into a receivership, and it is over a year since an arrangement was concluded at Los Angeles by which it was supposed an effective

plan of reörganization had been provided. Two syndicates, known as the European and American syndicates, respectively, were formed for the purpose of floating securities in order to pay the debts and complete the plant. The amount of money required before the securities could be issued was large; the stockholders' representatives gave no assurance that the necessary sums could or would be furnished by them; hence the court and receivers, whose duty to creditors and public required them to adjust the matter as speedily as possible upon a basis which should provide for the completion of the plant, co-operated with the representatives of the syndicates. The American syndicate proved unequal to the demands upon it, which increased with every month of unexpected delay. Finally the rights of this syndicate were offered to the American stockholders. This proposition, if it should have been carried out to its consummation, would have given the stockholders the same interest in the new company as in the old in return for a purchase of $150,000 in first mortgage bonds. But the stockholders did not respond, either because they were tired of the Bear Valley enterprise, or because they were advised to hold aloof by parties whose motive can only be surmised. The European syndicate has met all demands upon it and holds the property, which seems likely to become a purely English enterprise. The men behind it have ample means and can complete the property when they choose to do so. We have no doubt they will go forward, but there is no evidence to indicate how soon this will be done. Meanwhile, the development of large and valuable localities waits impatiently upon the issue. Looking back over the negotiations of the past year, it now seems a pity that President Greene's recommendation for an assessment upon all stockholders was not adopted. This would have cleared the field in a way to leave no just cause for complaint. It is also a pity that Engineer Hall was not summoned into the council of reörganizers to assist in the formulation of a plan for the stockholders and, later, for the investing public to whom the securities were to be offered. But at the time, every influential factor in the situation, including the committee of Eastern stockholders, was opposed to having anything to do with those who had previously managed the enterprise. They thought they saw a short cut to reörganization, but they have perhaps learned that "the longest way round is the shortest way home."

Effective Agencies. The experiment stations established by the Government and assisted by the States, are becoming a most important factor in the farm economy of the country. Trained observers with special facilities for investigation at hand, are doing effective work in promoting and encouraging agricultural and horticultural industries. As a supplement to these, the farmers' institutes, at which the officers and professors of the agricultural colleges and experimental stations attend as instructors, are a most important ally in the dissemination of sound principles and of tried methods, and taken together with the advantages of personal association and discussion, are making themselves apparent in better results and wider diffusion of home comforts and the promotion of better social relations.



Official Call for the Fourth National Irrigation Congress.

BY the authority of the National Executive Committee, the Fourth National Irrigation Congress is hereby called to meet in the city of Albuquerque, New Mexico, for the four days beginning September 16th, 1895.

The present year is proving to be the most remarkable in the history of American irrigation. It has seen a wonderful awakening of popular interest in the cause throughout the East, resulting in the organization of most potential forces for the purpose of co-operating with the Western people; the enactment of well-considered irrigation laws in eight States, and the creation of administrative systems in five of them; the recognition of the pressing nature of the problem by the Departments of Interior and of Agriculture, under whose direction a National Board of Irrigation has been formed from officials in various departments of the government.

These splendid evidences of the triumphant progress of the irrigation cause demand a large, representative and effective session of the Irrigation Congress in 1895. A further reason for such a gathering is the fact that the Presidential campaign of 1896 will be inaugurated previous to the assembling of another session of this body, and that it is thus necessary to formulate at Albuquerque the demands which the friends of irrigation will desire to make upon the great political parties of the nation.

In view of the nature of the opportunity, a programme of extraordinary variety, interest and importance will be arranged, and it is anticipated that this session of the Congress will be more widely useful and influential than the previous conventions at Salt Lake in 1891, at Los Angeles in 1893, and at Denver in 1894. The friends of irrigation throughout the United States—for to-day the movement is national in its scope and interest—should unite in an effort to obtain a worthy result at Albuquerque.

BASIS OF REPRESENTATION.

In accordance with a resolution of the Third National Irrigation Congress at Denver, Colorado, September 8th, 1894, the Fourth National Irrigation Congress will be composed as follows:

1. All members of the National Executive Committee.
2. All members of State and Territorial Irrigation Commissions.
3. Five delegates at large, to be appointed by their respective Governors, for each of the following States and Territories: Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah. Washington and Wyoming.
4. Three delegates at large, for each State and Territory not heretofore enumerated, to be appointed by the Governors of said States or Territories, or, in the case of the District of Columbia by the President.
5. One delegate each from regularly organized irrigation, agricultural and horticultural societies, and societies of Engineers, Irrigation Companies, Agricultural Colleges and Commercial bodies.
6. Duly accredited representatives of any foreign nation or colony, each member of the United States Senate and House of Representatives, and each Governor of a State or Territory will be admitted as honorary members.

The use of proxies and the manner of casting the vote of delegations, will be regulated in accordance with a resolution adopted at Denver, and printed on page 89 of the Official Report of that meeting. By order of

THE NATIONAL EXECUTIVE COMMITTEE,

FRED L. ALLES, Secretary. WILLIAM E. SMYTHE, Chairman.

THE CAUSE OF THE WEST IS THE CAUSE OF THE NATION.

A FACT WELL EMPHASIZED BY MASS MEETINGS FOR THE MOVEMENT IN BOSTON AND CHICAGO.

THE legislative triumphs won for irrigation in eight States of the West, as well as its significant recognition by the Executive Departments at Washington, have been discussed in THE IRRIGATION AGE. In order to appreciate the extraordinary strides which the cause is making it is also necessary to understand the full scope and meaning of the campaign under way in the East. The fact is, that popular and official influence have both been organized and brought to bear upon the great common end, the reclamation and settlement of Western America. The work that has been done in the East is supplemented by the work done in the West, and the work that has been undertaken by public officials at Washington will supplement both.

In the future men will look back upon the winter of 1895 as the period which marked the simultaneous awakening of the potential forces in the East and in the West to the opportunities of national achievement between the 97th meridian and the Pacific ocean. The work of shaping results is still before us, but the almost equally difficult task of enlisting those elements of support which alone make results possible has been accomplished.

It is expected that the Eastern campaign will be pushed forward several stages more before the September session of the Irrigation Congress at Albuquerque. Chairman Smythe is now in the West, arranging for the literature of the Colonial Clubs and considering plans for the development of labor colonies on the lands opened by the Carey act. He will shortly return to push the work in New England and other Eastern States.

I.—THE MOVEMENT IN NEW ENGLAND.

During the month of March Mr. Smythe addressed the Twentieth Century Club, composed of some of the strongest intellectual elements of New England, in Boston, and also the Parker Memorial Science Club in the same city. He was also invited to meet representatives of several of the notable literary and economic organizations of Boston, including young men from Harvard. These meetings have been already referred to in these pages.

THE BOSTON MASS MEETING.

The Boston mass meeting in the interest of the Western cause was held in Wells Memorial Hall on the evening of March 25th. The call was signed by a dozen of the most prominent Bostonians, including several labor leaders.

The *Boston Herald* speaks of the meeting as "large and enthusiastic," as indeed it was.

Dr. Edward Everett Hale presided, and made a vigorous and practical address, in which he said that Mrs. Partington might as well strive with her broom to sweep back the tides of the sea, as any selfish opposition to prevent the moving of population to the West. He said that though our government does nothing to inform us as to the statistics of interior emigration, it is known that two per cent. of the population of the seaboard States go West every year. This means that at least 40,000 people will leave Massachusetts this year. The object of the Colonial Club system will be to guide this inevitable emigration into channels where it can prosper, and to prevent people from being fleeced. [Dr. Hale's article in the *Commonwealth*, quoted elsewhere, presents quite fully his idea of the usefulness of the Colonial Clubs.]

Mr. Smythe began his speech with the declaration that "the cause of the West is the cause of the nation," and proceeded to show the relation between the surplus public lands and the economic problems of Eastern States. He quoted the revelations of recent strikes and the statistics of tenantry in various countries to prove the startling decadence of the American middle classes. He then asserted that past prosperity was due to the extension of civilization over new territory, and that the national prosperity would be restored by the renewal of the policy of continental conquest. The industrial and social systems of the Mormons were analyzed, followed by a study of the development of Greeley and Riverside.

The Carey law, and the action of Wyoming, Idaho, Colorado, Montana and Washington were described, and the plan for labor colonies from Boston, New York and Chicago fully set forth. The plans of the Colonial Clubs were then presented, and the first of these organizations formed with fifty members. Dr. Hale requested that his name should be enrolled as the first member.

Mr. Smythe preceded his address with an illustrated prelude, using stereopticon views, representing all parts of Western America. The views from Garden City were perhaps received with the greatest interest, as New England has large investments in Kansas mortgages. The audience was amazed at the difference between irrigated and non-irrigated farms on the great plains—the difference between poverty and hardship, and an assured living and prosperity.

INFLUENCE OF THE BOSTON MEETING.

The following circular, issued by leading citizens of Boston, tells its own story of the influence of the Boston meeting:

The organization of the annual emigration from Massachusetts to the West is a matter which deserves much more attention than it has received. Forty thousand persons go from Massachusetts into other states every year. Of course, in many instances, people know what they are about and go without hardship. On the other hand, in many instances, they are fleeced at every corner, arrive at their destination penniless and are great sufferers.

As a consequence of the recent visit of Mr. Smythe, the chairman of the National Irrigation Commission, several gentlemen have interested themselves in the formation of a Colony Club. It is not proposed that the members of the club shall themselves emigrate. It is proposed that an office shall be established here, which may receive and may scatter information on this subject from our Western States. You would be surprised if you knew how large a body of curious information has already been sent to this office, simply because of a meeting held by Mr. Smythe in this city. It is wholly impossible for us to attend to this correspondence, and it has seemed desirable that an organization should be formed which may care for such matters.

At a meeting of a few gentlemen at this office yesterday it was determined to invite the following persons to meet at the rooms of the Twentieth Century Club, 14 Ashburton Place, next Friday at noon. May we not ask you to be present then for half an hour's conference as to the formation of such an organization?

Please extend this invitation to any persons who you think would be interested.

The following gentlemen are those invited to attend the meeting.

Messrs.

Chas. Carleton Coffin,	Edwin A. Abbott,
D. Webster King,	W. A. Mowry,
W. L. Rutan,	A. C. Stockin,
Isaac F. Paul,	D. H. Clark,
Jonathan A. Lane,	S. N D. North,
Rev. Thomas Van Ness,	Rev. Christopher R. Eliot,
Francis Bellamy,	Charles H. Ames,
Sylvester Baxter,	John Holmes,
Rev. D. W Waldron,	Rev. Philip S. Moxom,
Prof. Davis R. Dewey,	Rev. W. E. Barton,

J. G. Thropp, Jr.

With great respect, we have the honor to be
Your obedient servants,

EDWARD E. HALE,
D. C. HEATH,
J. M. RODOCANACHI,
ALBERT WHITE VORSE.

Boston, April 9, 1895.

II.—THE MOVEMENT IN CHICAGO.

The work favorably inaugurated in New England, Mr. Smythe proceeded at once to Chicago to set the wheels in motion there. He was tendered the cordial support of the Home Seekers' Association, an organization recently started by prominent Chicago ministers. This was accepted and a public meeting arranged for April 11th at the First Methodist Church, corner Washington and Clark streets. This is a favorite public hall, in the heart of Chicago's business district. The Chicago newspapers gave the meeting very generous attention, and it drew a large audience. Rev. Dr. John Rusk presided and opened with a statement of the objects of the Home Seekers' Association and the irrigation propaganda.

Mr. Smythe declared that the issue now raised is not simply that of making homes for the people on agricultural lands, "but the mightier issue of founding a civilization, in a virgin empire, under a nobler conception of the rights of man." He followed the lines of his Boston speech, but made a striking comparison between Brigham Young and George M. Pullman as founders of industrial systems. Here is a part of it:

UTAH AND PULLMAN COMPARED.

"Both men are entitled to be called great captains of industry. Both men selected tracts of land which were barren and worthless until they reclaimed them. Both men gave large employment to labor, and directed that labor to the production of enormous wealth. But there was a wide difference in their methods, and a difference yet wider in the distribution of the wealth which the genius of each called into being.

"In Utah every laborer is a landed proprietor; in Pullman all are hopeless tenants. In Utah the many receive the benefit of increased real estate values which accrue from the coming of population; at Pullman these increased values are credited to the landlord and lay a new burden, in the shape of increased rent, upon the tenant. In Utah every laborer has the privilege of becoming a partner in factory, store and bank; at Pullman laborers are the compulsory patrons of these institutions and are made to pay dividends, rather than entitled to receive them. In Utah, under a system I have described, the laborer receives practically all he produces; in Pullman, under a system which the world knows by heart, the laborer receives only so much as suffices for a bare subsistance, and the rest of what he produces goes to the account of increased capital and to surplus and dividend funds.

"Now, when the depression of 1893 came on, the laborers at Pullman had nothing to fall back upon. They had received for their toil only enough to pay their living from day to day. Doubtless they had worked as faithfully as the men of Utah, but they had not received a fair share of what they produced. They did not own the soil on which they walked, nor the roof which sheltered them. No Mormon laborer felt perceptibly the pressure of hard times. No landlord knocked at his door to demand the rent. He stood there and looked the world in the face, the master of his acres. From those acres he can coin a prosperous living, while the earth yields her increase. And this, my friends, is the difference between these two systems of industry."

A large number of people joined the Colonial Clubs after the meeting. Other and larger meetings will shortly be held in Chicago, which is doubtless destined to be a storm center of the movement.

Mr. Smythe addressed the students of Chicago University on the evening of April 18th.

THE FUTURE OF THE MOVEMENT.

The campaign in the East has only begun. It will not reach its height until next autumn or winter, and perhaps not then, but it will constantly expand. Everything indicates that the membership of Colonial Clubs will quickly mount into the thousands.

It is also proposed to push arrangements for labor colonies on public lands as rapidly.



EMIGRATION WESTWARD.

BY EDWARD EVERETT HALE.

(In the *Boston Commonwealth.*)

MR. SMYTHE'S presence in Boston brings up again the eternally recurring questions which connect themselves with emigration from the old States to the new.

Nothing surprises intelligent foreigners so much as our ignorance, almost absolute, as to the statistics of this emigration. A distinguished educator from France, sent out by his own government, asked me once how many teachers from Massachusetts and from Connecticut were engaged in the Western schools. I laughed and told him that nobody knew in the world, or could guess. He said, in his broken English, that this was a thing unheard-of; that here were "two small provinces," as he called them, supplying at that time nine-tenths of the teachers for the rest of the country, and that nobody in America knew that it was so or cared that it was so.

George Holyoake spoke with the greatest earnestness on the subject when he was in this country. He said that every village in England was flooded with advertisements of rival railways, offering their lands to English emigrants. But he said there was no official statement of any sort to which people could be referred, by which they could judge how far the statements in these blatant advertisements were true. He said that the emigrant from England arrived at the pier in America absolutely ignorant of the country to which they came, and he said there was nobody in America who cared to give him disinterested information. So far as the personal conduct of emigrants from the East to the West goes, the arrangements of the Mormon Church are the only organized arrangements. You can see, on a steamer wharf sometimes, the agent of the Mormons, waiting for a party which is coming from England; he is going to take them to Utah. But if a person is so unfortunate that he is only a Christian, and not a member of the Church of the Latter Day Saints, he must just fight his way among a horde of leeches who want to get all his money before he is out of the sound of the waves of the sea.

When emigration to the West began, as early as 1783, the leaders of the Eastern States were frightened. There still exist old pamphlets, not to say old caricatures, which ridicule the desire to go West. In a dozen forms the old story is still told of the emigrant from a Massachusetts town, who went to Ohio carrying with him a jug of molasses, and came back boasting that he had sold his molasses for enough to pay for the molasses and the jug. On the right hand and on the left, every effort was made to persuade our people that they had better stay here and not trust themselves to the rich valleys of the Scioto and the Miami. Those who went and trusted themselves there were perfectly indifferent as to what was said to those who remained behind. And the caricature and the phamphlet are now left to the dust of antiquarian libraries, and only referred to as Mrs. Partington's broom is referred to, with which she tried to sweep back the waves of the sea.

All the same, however, little or nothing is known about the wave of emigration. De Tocqueville studied the matter with care, and gave to us the curious figure, which has been verified that the average flow of the wave, was, in his time, seventeen miles in a year. A similar flow began from the Pacific coast eastward, after we took a foothold in Oregon and California, and the two waves have met each other.

There are people to-day who are as unwilling to encourage emigration to the West from New England as their grandfathers were. They are a little apt to be the people who own tenement houses, ten stories high, and would be glad to make them twenty stories high if they could get good rents for the nineteenth and twentieth stories. They are people who are living under the delusion that a city, because its population is large, is prosperous and rich. But the prophecies of these people, and the Partingtonism, does not in the least affect the purpose of those people who wish to emigrate. As Abraham Lincoln would have said, those people who want to go want to go, and those people who mean to go mean to go. In point of fact, roughly speaking, two per cent. of the population of the Seaboard States move westward every year. It is a little curious, and it is satisfactory for us in Massachusetts, to observe that the attraction of Massachusetts to another set of people is, in its way, as great as, in its way, the attraction of the Western valleys. It would probably be fair to say that at this moment 280,000 persons born in Massachusetts are living in other States of the American Union, and that 280,000 persons born in other States are living in Massachusetts. The two fancies about meet each other. The account is about as broad as it is long.

It is for the 40,000 people who are going to move from Massachusetts westward this year that the persons interested in the unoccupied lands of the West propose to make arragements, for their convenient and easy emigration. It is just as well to have these people "personally conducted" to the West as it is have some delicate young lady who coughed twice last Wednesday personally conducted to San Diego by Messrs. Raymond & Whitcomb. It is just as easy to arrange that their emigration shall be comfortable and easy as it would be if they were all Latter Day Saints. At the interesting meeting held on Monday evening, the first Colony Club in Massachusetts was formed, not to make any particular colony for any particular place, but set on foot such arrangements as shall tend to the comfort of the forty thousand. The Colony Club proposes to collect and circulate information on the subject of open-air life in the West. It proposes some such mutual assistance as has proved possible in the Chautauqua circles and other great reading circles of the country. It proposes the establishment of similar clubs in all the larger centres of New England. And it cannot be doubted that under prudent and wise management a satisfactory result may be secured.

To a certain extent, the indifference of the general government towards interior emigration may be atoned for by such arrangements as these clubs may be able to make.

IRRIGATION AND STATE BOUNDARIES.

A PROBLEM OF THE ARID WEST AND ITS SOLUTION. PART II.

BY ORREN M. DONALDSON.

IN the IRRIGATION AGE for February I presented a plan for the repartitionment of arid America by drainage basins, as an ideal solution of the perplexing problem of the division of interstate waters, and as a radical remedy for the fundamental error in the existing system of State boundaries in the Western half of the United States. As to the degree in which such a proposition is practicable, there will doubtless be a wide difference of opinion. A few years of united effort on the part of the irrigation interests of the country would accomplish it; but such an effort is unlikely to be brought about, and it is well to recognize at the outset that whatever changes of boundary are made will have to be the result of aroused local sentiment; here a little and there a little, until perchance the incongruities and monstrosities of the present system of division are removed.

It will simplify matters somewhat to admit that the formation of the proposed States of North California, South California, West Texas and South Texas, is not necessary from the irrigation point of view, although they would help to maintain the proper equilibrium of power among the Commonwealths of the Pacific coast and of the extreme South. Of the remaining States and Territories many would undergo little modification in the repartitionment. Kansas and Nebraska would each retain practically its present area and population. Montana, Washington, Oregon, Nevada and Oklahoma would lose no essential part of their present identity, while Idaho and New Mexico would keep sufficient of their present territory and people to claim continuity of existence.

The same would be true of Colorado, although its partition would be one of the most serious difficulties to be confronted. A natural line of cleavage, however, follows the "Great Divide," and if once this line could be drawn the remainder would be comparatively easy of accomplishment. The southwest corner would gravitate toward the adjoining sections of the Rio Grande and San Juan basins, while the local pride of the southeastern quarter would help join it to those parts of the Arkansas river basin to the south and east for the formation of the State of South Colorado. The northeastern quarter, which would unite with the rest of the upper Platte basin to make the new Colorado, would retain fully one-half of the population of the present State. The interchange of territory and people between Colorado and Wyoming for the formation of the new Colorado and new Wyoming, would be well balanced. Wyoming retaining 17,500 square miles of its territory and 12,000 of its population, according to the census of 1890, would give to Colorado 26,800 square miles and 37,000 people, and would receive in return from Colorado 40,000 square miles and 49,000 people, Each State, under the new boundaries, would retain its present statehood, Colorado passing along the map, so to speak, to the east and north, and Wyoming passing to the west and south; the former to be composed wholly of the upper Platte river basin, including a section of Western Nebraska, and the latter of the upper Colorado river basin, including a section of Eastern Utah. An accessory before the fact in this change would be the division of the present Wyoming about midway of its width on an east and west line, following the water-shed between the Yellowstone basin and the Platte and Colorado basins. The whole Yellowstone basin could then be easily brought together in the Territory—or State—of Yellowstone.

The problem of the re-union of the Dakotas and their re-division along the line of the Missouri river could best be solved, perhaps, by making the new Dakota heir to the statehood of South Dakota and passing the sovereignty of North Dakota over to the new West Dakota. Thus each State would have a continuous existence. Nine-tenths of the inhabitants of North and South Dakota would be in the new Dakota. They would thus have to support one State instead of two, and would have a Commonwealth equal in population and development to many of the older members of the sisterhood of States. Its area is an agricultural unit, almost wholly in the humid region, and it ought not to be divided politically. West Dakota would be an irrigation State, new and undeveloped, but with sufficient population, under well established precedents, to warrant it a place in the Union.

The separation of Eastern Washington and Oregon from the parts of those States west of the mountains will probably come in the natural order of events. The City of Spokane ought to see to it that it becomes the capital of a State that shall include all the region between the Rockies and the Cascades north of the lower course of the Shoshone and the Columbia—one of the grandest empires on the continent. And then Walla Walla, or some other city, ought to follow the good example and gather around itself the corresponding territory south of the rivers and make another State of scarcely less importance. These divisions, for lack of better names, I have called, respectively, Missoula and Wallowa.

The remainder of the proposed changes are more simple. It ought not to be difficult for Idaho to acquire those small portions of the Shoshone basin now in Wyoming, Utah, Nevada and Oregon; or for Utah to acquire those parts of the Bear River valley in Wyoming and Idaho, or those sections of Arizona and Nevada tributary to the Kanab, Rio Virgen and other streams that flow south into the Colorado. Arizona could probably get from California and Nevada the narrow strip west of the lower course of the Colorado and tributary to it. And Nevada ought to be able to acquire from California the territory east of the Sierra Nevadas, and the lake region from Southern Oregon. Such accessions would nearly double the population and would add immensely to the economic

resources of the State, without objectionably increasing its area.

WHAT CONGRESS CAN DO.

There are a few important changes that it is still in the power of the Federal Government to make. The section of Arizona north of the Grand Cañon could be transferred by Congress to Utah; and the headwater region of the Gila river, from New Mexico to Arizona. The northwestern corner of Arizona, drained by the Little Colorado and San Juan could be joined to the northwestern third of New Mexico, drained by the Little Colorado, San Juan and Rio Grande (as far south as the 34th parallel), and the whole organized into a new Territory, with an area of 66,500 square miles and a population in 1890 of about 85,000. Then if that corner of Utah drained by the San Juan, and that corner of Colorado drained by the San Juan and Rio Grande, can be added to it, be it so; but if not the new Territory would have area, resources and population for the making of a great and powerful State. The remainder of New Mexico would have 74,000 square miles, with a population in 1890 of 72,000. The northern portion ought to join the rest of the upper Arkansas basin in the state of South Colorado; and the remainder, tributary to the Pecos and Rio Grande, should join the western end of Texas, tributary to the same rivers, in what I have called the State of Rio Grande. But if these last changes cannot be made, the Territory still has all the requirements for a successful commonwealth.

Congress also has power to incorporate Indian Territory with Oklahoma, which it ought to do, instead of organizing it into a new Territory as proposed by Senator Berry. Then if a little strip of Southern Kansas can be added to it, good; but if not, the Territory will still be well equipped for an early admission as a State.

It may be worth while to consider that the Carey law could probably be made to apply to new States in the arid region as well as to those already in existence. In that case several additional millions of acres of the public domain would be made available for reclamation and settlement under the repartitionment.

THE INTERNATIONAL PROBLEMS.

The international irrigation problems along the frontiers may one day find their settlement in Continental union. Until then they are not very serious. The basin of the Columbia river extends 250 miles north into British territory, but neither side of the international line in this region belongs strictly to the arid zone. East of the Rocky mountains, however, the boundary ought to be re-drawn a little farther north, so as to give to Montana and West Dakota the head waters of those streams that flow from the Canadian side and form a part of the Missouri system. In exchange for this, the United States might be willing to part, for the present with that corner of West Dakota through which the Moose river flows in, and back again, from the British domain.

On the Mexican frontier our government ought to purchase the territory on both sides of the Colorado river between the present boundary and the Gulf of California and to thus give to Arizona the undisputed right to the whole of the lower course of the river, together with the long desired opportunity for a seaport. Along the Rio Grande river the international irrigation problems could perhaps be solved most satisfactorily, to Americans, by the acquisition of that section of Mexican territory tributary to the Rio Grande system. In that case it would probably be desirable to acquire also the corresponding area directly to the west along the Gulf of California. This would give the United States at least two large and wealthy irrigation States south of the present Mexican boundary. But the possibility of such a solution may be too remote for serious consideration. There is, however, a 200-mile strip of Mexican territory along that portion of the river between El Paso and Presidio, where the water-shed lies but a short distance south of the stream, which might be purchased and added to the area of the State on the American side. This would probably obviate any international dispute as to the division of waters caught or stored in American territory.

BOUNDARIES OUGHT TO BE CHANGED.

State boundaries are not sacred monuments to be held under all conditions forever inviolate. We live as a Nation under no injunction to "Remove not the ancient landmark which thy fathers have set." The Federal Constitution makes express provision for such changes in declaring that "New States may be admitted by the Congress into this Union; but no new State shall be formed or erected within the jurisdiction of any other State; nor any State be formed by the junction of two or more States or parts of States, *without the consent of the legislatures of the States concerned as well as of the Congress.*" Very early in the history of the country Virginia gave a portion of her domain for the formation of Kentucky: North Carolina gave of her territory to make Tennessee, and Virginia and Connecticut ceded to the Federal Government their rights north of the Ohio river for the organization of the Northwest Territory. Since then changes in State and Territorial lines have not been infrequent. Surely Kansas, Nebraska, the Dakotas, Wyoming, Colorado and the other States of the West ought not to hesitate if the good of the Nation demands that they follow such illustrious and patriotic examples.

It cannot be claimed that this western country has reached a stage of advancement where such a redrawing of boundaries must not be permitted. In 1890 the whole of the arid region had a population only equal to that of the Thirteen Colonies at the close of the Revolutionary War, about 3,000,000 souls; and all the territory west of the 97th meridian, including the larger parts of Texas, Kansas and Nebraska, had only about 5,000,000, which was the population of the United States by the Census of 1800.

The West of to-day is to the West of the future what the Thirteen Colonies were to the America of this last decade of the Nineteenth Century. Its civilization is but begun and irrigation is its paramount interest, its corner stone. We are building for a thousand years—perhaps ten thousand. Measured in the light of the possibilities of the future, these basic errors of boundary take on colossal proportions. They cannot be continued without our becoming *particeps criminis* in their evil results. The peace and prosperity of the West and the best good of the American Republic demand that they be remedied, and without delay.

THE IRRIGATION OF ILLINOIS.

SAMUEL J. WALLACE.

THE future development of agriculture, in its broad sense, will differ very much from that in the past and will be largely the development of irrigation. And the irrigation of the future will include much beyond the simple thing now known as irrigation, the mere providing and application of water to the soil, and will cover the whole subject of water in its relation to the soil.

The future development of irrigation will include not only means for storing and taking water to the soil, and its application to it, but also means for taking its excess away, as in underdraining, now a separate thing, and means for its reapplication where needed; and, also, means for storing up water in the soil, as by underground reservoirs and deep trenching, to continually feed it, now hardly known; and, as well, means to keep the soil filled all the year with live and constantly active roots to take up the nitrates and phophates that go into solution continually, and are now largely lost by being carried away in the drainage; as by fruit and food-producing trees and winter crops.

Illinois, Indiana, Ohio and New York are the Fortunate Ones among the countries of the world for irrigation. These States, with their neighboring sisters are especially ill-situated for local irrigation because the streams lie so far below the general farm level; yet the future will spread the irrigation ditch over their statute books that now know it not, and over their beautiful faces the waters of everlasting youth, bright with the riches of Eldorado. But these four States are the favored ones with the queenly crowns of their great lakes which endow them with the waters of life and riches without limited measure or fail, as much as they need forever. Not only are they fortunate ones in lying below great lakes for irrigation—reservoirs worth numberless millions of expenditure, built by their grandfather, the ice king, with unbreakable dams of earth and gravel and overflow lips of rock—but they are also fortunate in having their surfaces leveled up for such irrigation by the ice, and covered deep with soil rich with pulverized rock, and worth other numberless millions of expenditure.

Most fortunate of all is Illinois, with her great city of the future, set as a jewel on her reservoir crown; so fortunately set as to be ready to pour over her tributary lands by irrigation canals the riches of nitrates of potash and phosphates from many lands by gravitation as no other great city can do.

This endowment soon or late is inevitable. The minds of men, molders of history, may not awake at once to what is before them, when outside of what they are used to. But irrigation is too necessary and its progress too resistless to stay until it has developed the possibilities so plainly in sight.

So Chicago will some time turn back on to her State the precious basis of life, though other cities continue to draw the scant vitality from their lands and send it down to the seashores forever.

The way for this should now be left open, by those who mold her drainage system and the system of canals now in progress, for science and the arts move so fast it will not be wise to assume that things will not be done differently hereafter, and that the unexpected will not happen.

It will not do to make a bugbear of the idea that sewage will not be suited for distribution by irrigation canals before we know what the future can do. Certainly, if no new art at all were used, with an adequate proportion of water and rate of flow, sewage would be reduced to its elements in a remarkably short distance by microbes when open to the sunlight at the temperatures that would exist in a canal; and the baccilli of diseases, as well as the innocent, would become innocuous or dead sooner and more safely than if turned into the cold waters of the deep lake, where they now go, or into the more diluted waters of the river, the only other alternative open.

So, sanitation may join agriculture in the demands of iron necessity for such development. The writer knows the necessity of irrigation in Illinois, from experience.



WHAT, WHEN AND HOW TO SPRAY.

PLANT.	1st Application.	2d Application.	3d Application.	4th Application.	5th Application	6th Application
APPLE..... (Scab, codlin moth, and bud moth.)	When the buds are swelling, copper sulphate solution.	Just before blossoms open, Bordeaux. For bud moth, arsenites when leaf buds open.	When blossom has fallen, Bordeaux and arsenites.	8-12 days later, Bordeaux and arsenites.	10-14 days later, Bordeaux.	10-14 days later, Bordeaux.
BEAN..... (Anthracnose.)	When third leaf expands, Bordeaux.	10 days later, Bordeaux.	14 days later, Bordeaux.	14 days later, Bordeaux.		
CABBAGE..... (Worms, aphis.)	When worms or aphis are first seen, kerosene emulsion.	7-10 days, later if not heading, renew emulsion.	7-10 days later, if heading, hot water, 130 degrees Fahr.	Repeat third in 10-14 days if necessary.		
CHERRY..... (Rot, aphis, slug.)	As buds are breaking, Bordeaux; when aphis appears, kerosene emulsion.	When fruit has set, Bordeaux. If slugs appear dust leaves with air-slacked lime. Hellebore.	10-14 days if rot appears, Bordeaux.	10-14 days later, ammoniacal copper carbonate.		
CURRANT..... (Mildew, worms.)	At first sign of worms, arsenites.	10 days later, hellebore. If leaves mildew, Bordeaux.	If worms persist, hellebore.	10-14 days later, repeat third.		
GOOSEBERRY..... (Mildew.)	When leaves expand, Bordeaux.	10-14 days later, Bordeaux.	10-14 days later, ammoniacal copper carbonate.	10-14 days later, Bordeaux.	10-14 days later, if any disease appears, Bordeaux.	10-14 days, ammoniacal copper carbonate; make later applications of this if necessary.
GRAPE..... (Fungous diseases.)	In spring when buds swell, copper sulphate solution.	When leaves are 1-1½ inches in diameter, Bordeaux.	When flowers are open, Bordeaux.			
NURSERY STOCK..... (Fungous diseases.)	When first leaves appear, Bordeaux.	10-14 days, repeat first.	10-14 days, repeat first.	10-14 days, repeat first.	10-14 days repeat first.	10-14 days, repeat first.
PEACH, NECTARINE... (Rot, mildew.)	Before buds swell, copper sulphate solution.	Before flowers open, Bordeaux.	When fruit is nearly grown, Bordeaux.	5-7 days later, ammoniacal copper carbonate.	5-7 days later, repeat fourth.	5-7 days later, repeat fourth, if necessary.
PEAR..... (Leaf blight, scab, psylla and codlin moth.)	As buds are swelling, copper sulphate solution.	Just before blossoms open, Bordeaux. Kerosene emulsion when leaves open, for psylla.	After blossom has fallen, Bordeaux and arsenites. Kerosene emulsion if necessary.	8-12 days later, repeat third.	10-14 days later, Bordeaux.	10-14 days later, Bordeaux, if necessary.
PLUM..... (Fungous diseases, curculio.)	When buds are swelling, copper sulphate solution.	When blossoms have fallen, Bordeaux. Begin to jar trees for curculio.	10-14 days later, Bordeaux.	10-20 days later, Bordeaux.	10-20 days later, ammoniacal copper carbonate.	2-3 weeks before plums ripen, Bordeaux or ammoniacal copper carbonate.
POTATO..... (Blight, beetles.)	When beetles first appear, arsenites.	When vines are two-thirds grown, Bordeaux and arsenites.	5-15 days later, Bordeaux.			
QUINCE..... (Leaf and fruit spots)	When blossom buds appear, Bordeaux.	When fruit has set, Bordeaux.	10-20 days later, Bordeaux.	10-20 days later, Bordeax.	10-20 days later, Bordeaux.	
RASPBERRY, BLACKBERRY, DEWBERRY, (Anthracnose.	Before buds break, copper sulphate solution.	During summer, if rust appears on leaves, Bordeaux	(Orange or red rust is best treated by destroying the plants)			
STRAWBERRY..... (Rust.)	As first fruits are setting, Bordeaux.	As first fruits are ripening, ammoniacal copper carbonate.	When last fruits are harvested, Bordeaux.	Repeat third if foliage rusts.		
TOMATO..... (Rot, blight.)	At first appearance of blight or rot Bordeaux.	Repeat first if diseases are not checked.	Repeat first when necessary.			

ALL well informed orchardists of experience recognize the prime necessity of properly spraying their trees. In no part of the United States are the orchards so free from disease and insect enemies as to relieve the fruit grower from the labor and expense of waging an annual warfare against his tireless foes. It is alleged that in spite of all the efforts directed to the destruction of noxious insects, the annual loss to the farmer and fruit grower from this cause alone amounts to hundreds of millions of dollars. In view, therefore, of the transcendent importance of a correct knowledge of the subject of proper and timely spraying of orchards, it is hoped that the subject as herein presented may meet with the approbation of orchardists generally. For much of the valuable information here given we are indebted to the careful and prolonged researches of Professor Bailey, of the Experiment Station at Cornell University, New York. The information conveyed by the table and formula following may be easily worth to a single orchardist a hundred times the yearly cost of THE IRRIGATION AGE, and this number should be carefully preserved for future use, for the orchardist will certainly have frequent need to draw upon these pages for guidance in his work.—*The Irrigation Age for June, 1894.*

Following will be found formula for preparing most of the spraying compounds recommended in the foregoing table, and the list should be scrupulously preserved for reference.

AMMONIACAL COPPER CARBONATE.—Copper carbonate, 1 ounce; ammonia, enough to dissolve the copper; water, 6 gallons. The copper carbonate is best dissolved in large bottles, where it will keep indefinitely, and it should be diluted with water as required. For same purpose as Bordeaux.

COPPER SULPHATE SOLUTION.—Copper sulphate, 1 pound; water, 15 gallons. Dissolve the copper sulphate in the water, when it is ready for use. This should never be applied to foliage, but must be used before the buds break. For peaches and nectarines use 25 gallons of water for fungous diseases.

PARIS GREEN.—Paris green, 1 pound; water, 250 gallons. If this mixture is to be used upon peach trees, one pound quicklime should be added. Repeated applications will injure most foliage unless lime is added. Paris green and Bordeaux can be applied together with perfect safety. The action of neither is weakened, and the Paris green loses all caustic properties. For insects which chew.

LONDON PURPLE.—This is used in the same proportion as Paris green, but as it more caustic it should be applied with the lime or with the Bordeaux mixture. Do not use it on peach or plum trees. For insects which chew.

HELLEBORE. - Fresh white hellebore, 1 ounce; water, 3 gallons. Apply when thoroughly mixed. For insects which chew.

KEROSENE EMULSION.—Hard soap, ½ pound; boiling water, 1 gallon; kerosene, 2 gallons. Dissolve the soap in the water, add the kerosene, and churn with a pump for five or ten minutes. Dilute ten or fifteen times before applying. For insects which suck, cabbage worms, and all insects which have soft bodies.

BORDEAUX MIXTURE.—Copper sulphate, 6 pounds; quicklime, 4 pounds; water, 40 gallons. Dissolve the copper sulphate by putting it in a bag of coarse cloth and hanging this in a vessel holding at least four gallons, so that it is just covered by the water. Use an earthen or wooden vessel. Slack the lime in an equal amount of water. Then mix the two and add enough water to make forty gallons. It is then ready for immediate use. For rots, moulds, mildews and all fungous diseases.

Black knots on plums or cherries should be cut out and burned as soon as discovered.

For aphides or plant lice use kerosene emulsion on all plants.

Paris green and London purple are "arsenites."

The Cornell mixture is a combination of Paris green and kerosene emulsion (the two principal insecticides) and Bordeaux mixture (the principle fungicide) into one mixture. [P.S.—The experiments with this compound were not a complete success, but something practical may result in the future,]

GARDEN CROPS UNDER THE DITCH.

WITH proper management the farmer can grow a succession of two or three crops on every acre of his vegetable garden, throughout the year. If this is being done as far north as Green Bay, Wis., what can not be done under the superior conditions afforded the Western irrigation farmer?

As THE AGE numbers among its readers farmers through all portions of the Arid West. where conditions vary widely, only general information regarding the management of vegetable crops can be given.

The most important point, after that of securing only the *best* seeds, is the preparation and fertilization of the soil. Deep plowing and a thorough pulverization of the soil should be the rule, so that the manures applied shall be thoroughly incorporated. Outside of the benefit of securing a perfect seed bed, this deep stirring of the garden tends to the retention of the moisture in the soil.

IRISH POTATOES.

The largest crop of potatoes ever grown in the States on a measured acre at one planting, was raised under irrigation by W. J. Sturges, of Buffalo, Johnson County, Wyoming, in 1890 (974 bushels, 48 pounds), thus forcibly illustrating the value of irrigation for securing the best returns.

It is usually advantageous to spread out the tubers intended for seed on the floor where the sun can reach them for a few days so that the eyes will start growing. Cut the seed tubers two eyes to a piece, and plant in rows from 3½ feet to 4 feet apart, the tubers being from 12 to 18 inches apart in the row. Enterprising farmers to-day are treating their seed potatoes for scab, by steeping them 90 minutes in a solution of corrosive sublimate.

In some sections the practice is not to irrigate as long as the vines continue growing, but when they begin to wither and turn yellow around the roots, to water them. Make deep channels with the shovel plow, having wings attached in order that the water may not touch the vines, arranging the beds so that the lower end of the rows will not be flooded. As soon as the ground is in condition to work after irrigating and before it becomes hard and baked, cultivate the surface soil thoroughly.

An overabundance of water will result in large, soggy tubers, unfit for the table unless baked, as they contain an unusual percentage of water to that of starch. It is only a question of time before potatoes will be sold at so much per starch contents, the same as creameries pay the farmer for the amount of butter fat in their milk, or the sugar factory men according to the percentage of sugar in the farmers' beets.

Nearly two million bushels of potatoes are yearly imported into the States, so that there is not enough grown to fill our home markets.

ASPARAGUS

is always a good and profitable crop. A convenient method is to make the beds in "floor," over which a thin sheet of water may be run from a furrow at the head, toward another at the foot, from which the water may again be flowed over another "floor" below the first. This crop can be raised either from seed or roots. As it requires three or four years to procure a good stand from seed, many consider it better to plant one- or two-year-old roots. For garden culture it is customary to set them out in rows four feet apart, and two feet apart in the row, about two inches be-

neath the surface. Keep the bed clear of weeds and irrigate every two or three weeks the first and second years, adding a good coat of well-rotted manure or so-called complete fertilizer every season.

The third year the bed will be in full bearing. Irrigate thoroughly during the cutting season, and about once a month the balance of the year.

BEANS,

whether bush or pole "Snap," or bush or pole "Lima," should be grown on beds accessible to water, as they can stand irrigating every week in some sections. Plant the seed in drills two and a half feet apart.

CABBAGE.

This succulent vegetable is a standard crop on the Coast, Puget Sound already having scored a success as a center for raising cabbage seed.

The seed is usually started in hot beds or cold frames for the early crop, and transplanted into the field into rows two and a half feet to three feet apart, the plants eighteen inches apart in the rows. When the ground is in fit condition an expert gardener can set out 5,000 a day with the assistance of a boy to drop plants, but it is back-breaking and no slouch of a job to set out 2,000 to 3,000 plants in a day. Machinery is being used in the East to set out tobacco and cabbage plants, with success. The plants should be set in the ground up to the first two leaves and the soil firmed around them.

It is not unusual to shade the newly set out plants for a day or so until new roots are formed. Irrigate immediately after setting out to assist root formation, and as soon as the soil is dry enough cultivate.

The cabbage plant responds readily to fertilizers and cultivation.

Irrigate as needed until heads commence to form, but not thereafter, as the heads are very apt to burst if irrigated during this period of growth.

The above method can also be followed for cauliflower, borecole, brussels sprouts, etc.

Near Anacortes, Wash., first-class cauliflower seeds are being successfully raised.

BEETS.

This seed is usually sown in drills eighteen inches apart, and about an inch deep.

Authorities now strongly advise not to irrigate this or other root crops unless to supply sufficient moisture to germinate the seed, but to cultivate the soil well and often.

TURNIPS, PARSNIPS AND CARROTS

can be sown in drills eighteen inches apart, and half an inch deep. Water can be applied until the roots commence to form, or until the plant shades the ground, but thereafter irrigating tends to make the roots rot.

ONIONS A SUCCESS UNDER IRRIGATION.

This plant requires that the seed be sown on the top of ridges. Two rows may be grown on each ridge, the rows being six inches apart. No vegetable requires more careful handling under irrigation, as the water should not be allowed to touch the bulb, nor should the soil be drawn around it.

This is a very profitable crop, and some gardeners in the East sow the seed in beds, and transplant in a similar manner as to cabbage. Generally, however, it is the larger varieties that are recommended for this method of cultivation, the extra cost in time and labor in setting out the onion plants being about offset by the greater freedom of such beds from weeds than usual in the older method of sowing the seed where the crop is to be grown, thinning, etc. The large Spanish onion is grown in Europe under irrigation and there seems no good reason why this crop cannot be grown successfully in America to supply the home demands of our markets.

SQUASH.

This delicious product of the garden (vegetable marrow) thrives in almost any soil, and well repays by increased returns for the care bestowed on it for manure and cultivation. It needs little water, sometimes none at all.

The usual method is to manure, and sow the seeds in hills about four feet apart each way, allowing three plants to grow in each hill.

SWEET POTATOES.

Tubers for this crop are planted in beds about the same as Irish potatoes, the vines grown from this bed being used to set out the field for the regular crop.

The land is thrown up into ridges by horse plow or a sweet potato hiller three feet apart, and the sweet potato vine cuttings are set out on the top of the ridges sixteen inches apart.

Irrigate between the ridges, but put no water on the plant, as it is liable to cause sun scald. It is usually necessary to have the soil moist when setting out vines after cultivation, to keep the field free from weeds, using discretion when applying water, much as for Irish potatoes.

TOMATOES.

The seed for this crop is usually grown under glass in hot or cold frames, and the plants set out in the field after they have attained some size.

They are then set out in rows, six feet apart, and the plants three feet apart in the rows.

Irrigate immediately after setting out, keeping the soil free from weeds and loose. Do not irrigate after the fruit has set, as this is liable to cause it to crack and rot.

PEAS

thrive under irrigation and should have plenty of moisture, especially when in bloom.

Sow the seed in drills, allowing three feet between the rows, and for a succession, sow every week or ten days. This crop responds readily to good culture and manures.

LETTUCE, RADISH, SPINACH, PARSLEY, ETC.,

are cultivated in beds so arranged as to allow of irrigation from a furrow at the ridge. Sow the seed in rows from sixteen to eighteen inches apart, giving an abundant supply of water at all stages of growth. Keep the ground moist and loose all the time.

A Large Grape Vine.—A vine (supposed to be *vitis æstivalis*) growing on the Rose Dhu plantation, May River, South Carolina, at the base of a large live oak, measures at 3 feet from the ground, 48 inches in girth, and at 1 foot from the ground 54 inches in girth. One of the large cable-like limbs extends out near the adjacent marsh, then dips down into the mud, in which it is somewhat buried, doubtless deriving some sustenance and growth from the salt water, which laves it at every tide. Other portions of the vine clamber out and clasp the large

limbs of the oak in innumerable folds of cordage, covering the oak from top to bottom, then extending out to and covering two other live oaks, one to the right and the other to the left of the central tree, the distance between which measures at least twenty paces—thus making the finest picture of a true "forest Laocoön" which is, perhaps, to be seen on the Carolina coast.

The New Bordeaux Mixture.—Quicklime, 4 lbs. 6 ozs.; sulphate of copper, 4 lbs. 6 ozs.; molasses, 4 lbs. 6 ozs.; water, 22 gallons. This was suggested by M. Michel Perret at a meeting of the National Agricultural Society of France, as being less liable to injure, or be washed off by rain from the foliage of plants, etc.

M. Perret's instructions for making are, "Add the molasses to 13 gallons of water, then slack the lime and add 4½ gallons of water to form a milk of lime. Pour this slowly into the sweetened water, stirring briskly in order to mix intimately. Next, in a third (wooden) vessel, dissolve the blue stone and pour this into the previous mixture, stirring well. In this blending of materials chemical changes are taking place. When the milk of lime and sweetened solution are intimately mixed together, then saccharate of lime is formed. Next, when to this is added the solution of sulphate of copper, a double decomposition takes place: sulphate of lime is formed on the one hand and soluble saccharate of copper on the other. Saccharate of copper is only formed in presence of an excess of lime, and is indicated by the mixture assuming a beautiful greenish tinge. This renders the mixture alkaline, and the lime neutralizes the acid.

Diseased Orange Trees.—A writer in the Marysville (California) *Appeal* alleges that a dangerous disease has attacked the splendid orange orchards of the northern section of the State. It is certainly to be hoped that this disease has not made great headway as yet and that prompt measures for its suppression be taken. The *Appeal* says:

"In nearly all the orange groves throughout the Northern Citrus Belt, there are a number of orange trees affected with a disease known by the common names of 'blight,' 'go back' or 'wilt.' The first sign exhibited by trees attacked, is a sudden wilting of the leaves and in a majority of cases the entire top is affected, which soon shrivels up and dies. This disease is very destructive and trees attacked by it rarely ever recover; the trunk remains green and fresh for a time and if the shriveled tops are cut off, new shoots will often start out lower down, but they never attain any important growth as the tree eventually dies completely.

"'Blight' or 'go back' is undoubtedly a disease of the roots. On taking out a number of the diseased trees a few days ago the roots were found to be badly decayed and gave off a sour and sickening odor.

"The cause of the disease, or the remedy for it is entirely unknown; that it is connected with excessive moisture or rainfall every observer must admit; that it is not caused by water alone is equally true."

A Lesson from the Great Freeze.—A writer in *Garden and Forest* states that the late freeze (with the single exception of one grove) killed outright all the orange tree around Pass Christian, Miss.

The owner of this grove is an intelligent Italian, who is reported as saying: "My father cultivates oranges near Naples, and his practice is the one generally employed there as a safeguard against periods of excessive cold. In autumn he scrapes away the rich top soil from the roots of his trees and allows them to dry, and since he irrigates his grove he at this time withholds all water. The trees are then at rest, except for the ripening fruit, which seems to be as good as that in irrigated groves. If freezing temperature comes, these exposed roots freeze with the tree, and yet he claims their dormant condition and lack of sap protects them from harm. As to the correctness of his theory, I am not able to pass judgment. I only know that his trees stand with bared roots all winter until there are signs of spring and returning vitality and flowing sap, when applies his fertilizers and throws back the soil and begins to irrigate."

The one tree lost in this grove stood in the rear of his house where the waste water from the kitchen reached its roots. This tree was in a growing condition in the autumn, and the frost killed it. My attention was called to the fact that after the first frost every orange tree in his grove cast its leaves, which their proprietor noted as a sign of life, for trees struck by lightning or otherwise deadened hold their dead foliage, apparently without the power to cast it off.

A Wise Move.—The fruit growers of Grand Junction, Colo., are discussing the possibility of transporting the wasting stable manures from Leadville to their valley orchards. There ought to be no question about getting a railway rate that will justify it. It is a fact beyond controversy that while land in its natural state may be so fertile as to produce a paying crop, the addition of fertilizers, judiciously, will increase the profits greatly. For illustration, an acre planted to orchard will not have cost less than $100. If it should yield a net income of $25 it would be a good investment and a fair profit. If by the addition of $20 an acre the net return may be increased to $50, as it is practically certain to be, even if the whole cost of the fertilizer is charged to current expense, it needs no argument to justify the outlay for fertilizers. In practice the benefits are found to be even greater proportionately than above indicated. The acre of land which yields as an average return $50 an acre net is worth, allowing for all contingencies, $250. If it yields but $25 it is worth only $125. There are then two inducements to the orchardists to fertilize the land—the increased annual profit, and the enhanced value.

The Home Market Most Important.—Dr. Joseph Nimmo, the eminent statistician, announced in a recent address at Columbia College, Washington, D. C., that the total value of the products of labor in the United States for the year 1890, reached the wholly incomprehensible amount of eighteen thousand million dollars. Of this amount, only $845,000,000 worth of products were exported, or only 4.7 per cent. of the value of the products of labor for that year. From these figures it is easily seen how relatively unimportant all our foreign trade is, when compared to our internal commerce. As a general proposition the home market is the best market, and it is the interest of all soil tillers to encourage and build up home industries and home markets. If we take away from the total value of exports for the year 1890, as given above, the value of the cotton ($251,000,-

000) and breadstuffs ($106,000,000,) sent out of the country for that year, there would remain but 2½ per cent. as the total export of the products of labor. It must be clear, therefore, that American farmers must depend mainly upon American markets to absorb their surplus products. And when the great body of farmers shall refuse longer to scramble in foreign markets in competition with half-naked barbarians in other countries, and produce more especially for the requirements of our incomparably more valuable home market, their condition will almost certainly improve. Our farmers should produce for export only such commodities as the cheap labor countries cannot so readily produce in competition, which if continued, must certainly prove disastrous to American husbandry.

Feeding Wheat in the Sheaf.—Hand in hand with the exact determinations of science should go the careful practical tests of every-day observation by competent men. It has been shown at a number of the Agricultural Experiment Stations that the feeding values of wheat and corn are nearly equal for swine, and that in both cases the values are greater than the current market price for those grains. A number of careful feeders among the farmers observed that when fed wheat without crushing, hogs failed to fully masticate the grain, and a considerable loss was sustained through the excretion of undigested food. It was found that the pigs devoured the wheat with such avidity that proper mastication was impossible; and to avoid this difficulty the custom was adopted of feeding wheat in the sheaf. It was found that the time consumed in disposing of a ration of wheat thus administered was much greater, and that mastication and digestion were much better performed. This matter should be well looked after by those who are feeding wheat to swine, and if it be found that better results are to be had from feeding the grain in the sheaf it is well that it become generally known. In this connection the actual experience of practical men may be of advantage, and that of Mr. C. H. Brown, of Idaho, as given in the *Breeders' Gazette* is here presented, as follows: "There is no corn raised in this section of the country, so we have had to depend altogether on wheat or barley in fattening our pigs. The only drawback was that the grain feed was not digested. For the past month I have been feeding my pigs on sheaf wheat and have been surprised at the good results that have followed. I find on examining the droppings that it is almost impossible to find a whole kernel in some. I have watched them feed and find what they would eat in five minutes if fed in a trough will last them half an hour, and there is no crowding of the smaller ones by the larger. Besides the saving in thrashing, I think all farmers who follow this plan will be pleased with the results."

The Greatest Forest in the World.—Siberia from the plain of the Obi river on the west, to the valley of the Indighirka on the east, embracing the great plains or river valleys of the Yenisei, Olenek, Lena, and Yena, is one great timber belt, averaging more than a thousand miles in breadth from North to South,—being fully 1,700 miles wide in the Yenisei district,—and having a length from east to west of not less than 3,000 miles. In the Yenisei, Lena and Olenek regions are thousands of square miles of several varieties of pines, firs, and larches, where n human being has ever been.

The dense lofty tops of the *taigas*, exclude the pale Arctic sunshine, and the straight, pale trunks, all looking exactly alike, so bewilder the eye in the obscurity, that all sense of direction is soon lost. The most experienced sable trappers dare not venture into the dense taigas without the precaution of blazing the trees constantly with hatchets as they walk forward. If lost there the hunter rarely finds his way out, but perishes miserably from starvation and cold.

The forest of Washington, northward through British Columbia and Alaska is probably the largest continuous timbered area in North America, while that in the valley of the Amazon, including Guiana, Colombia, Ecuador, Bolivia, Eastern Peru, and Northern Brazil, the largest on this continent. The preservation of the forests is an exceedingly important question.

Food for Thought.—General freight agent Moore, of the Northern Pacific Railroad, makes some suggestions to the farmers of the Northwest, which are worthy to be considered in any and every section: "About 800 cars of hams, bacon, pork and lard are shipped annually to points in Montana, Washington and Oregon. This is equal to 20,000,000 pounds. The cash for this packing-house product goes from those States to Kansas, Nebraska, Illinois and Iowa. Why should not Northern Minnesota and North Dakota supply this product, and receive the cash that is now sent to those States south of us? Consider the enormous quantity of packing-house product consumed in St. Paul, Minneapolis, Duluth and Superior, and in the lumber and mining camps of Minnesota and the farming districts of North Dakota. Some hogs are now being supplied from Southern Minnesota, and some also are being shipped from the Red River valley to the packing house at South St. Paul. Fully 150 car loads of butter, eggs and cheese are shipped annually from east and south of St. Paul to points in the Northwest. Kansas and Iowa supply a large share of this, and naturally the cash goes back to those States. A pickle or cucumber is a small thing, yet from 150 to 200 car loads of pickles in vinegar and chow-chow are shipped annually to points in the Northwest between Duluth and St. Paul, Minn., and Portland, Ore. We also carefully investigated with the commission merchants of the Twin Cities the average prices paid for vegetables, and find that onions have averaged, 50 cents per bushel, potatoes, 20 and 25 cents per bushel; peas, which are now received principally from Wisconsin and Michigan, 90 cents to $1.50; navy beans, $1.60 to $2 per bushel. One hundred car loads of the latter are consumed annually in this market, and are supplied principally by California, Michigan and Wisconsin. Rutabagas, 30 to 50 cents per bushel; cabbage, $8 to $12 per ton. These figures represent average prices over a period of several years. If we want a prosperous farming and business community we must keep a large share of the cash now being paid out to foreign States for supplies in Minnesota, Dakota, Montana and Washington."

Shelling or Rattling of Grapes.—E. G. Lodeman of Cornell University finds this disease is caused by a lack or potash in the soil; probably caused by continuous cropping of the soil before planted to grapes, overbearing overgrowth of wood, leaves, etc.

Cotton Seed.—Thirty years ago in every Southern State the cotton seed was thrown away as worthless or used as fuel. For two-thirds of a century attempts had been made to compress the oil that it contains, but failure had followed failure. It was a waste product until the saving hand of genius touched it, and like magic a great industry sprang into existence, says the *Industrial World.* What had a few years before been left to rot at the cotton gin, rose in value with a wonderful rapidity, until at one time it sold at $19 a ton. To-day the product of this country exceeds $27,000,000 a year in value. Only one-third the seed is used as yet, and this wonderful industry but waits upon a market for the oil, either in adulterations of lard or olive oil, or some more innocent occupation, to triple its great output.

Small Things.—There are people who despise the poultry business because it is a "little business." The man who invented the return ball for children to play with made $100,000 out of it. The man who invented roller skates made $300,000 out of his invention, while the man who invented the game of pigs in clover made $60,000. As a rule, little things pay the best.

Sorghum is another valuable crop for feeding cattle and other stock. George Schornich, on his ranch near Mesa City, Arizona, last year raised thirty tons to the acre. He raises many hogs and finds that sorghum is an excellent feed for fattening purposes in connection with alfalfa. He also saves and sells the seed, which nets quite a sum per acre.

Gardening in Arizona. — There is a mint of money in gardening in the more favored parts of Arizona. It should be specialized and studied intelligently. For instance, one party a mile south of Phoenix, makes a specialty of celery and cauliflower. He plants his ground in August and harvests his 15-pound heads of cauliflower from Christmas on—figure on the profits, you who know about such things.

Exportation of Cattle.—Speaking of the decree issued last week by the French government prohibiting the importation of American cattle, Nelson Morris, the well-known packer, in a recent interview, said: "We shipped $18,000,000 worth of cattle and products alone to France last year, and this great trade is absolutely destroyed by the order of the French government. I knew this was coming some months ago, and with the exception of two or three boat-loads no cattle or product has been sent to France in the last ten days. The effect of the German and Belgian embargo has been to reduce the price of cattle of the classes shipped to these countries by $10 a head, and this French edict will even more injuriously affect the stock prices. This has been the effect on prices, notwithstanding the fact that the supply of cattle has been cut down to two-thirds on account of no feeding supplies."

Capon Flesh.—It is stated that Americans have not been educated to appreciate capon flesh. Americans have not been educated, as a whole, to appreciate the best meats of any kind. But they are learning all the time the difference between tasteless, tough meats, and well flavored, tender and juicy roasts and steaks.—*Farmers' Voice.*

Another Orchard Enemy.—A new orchard enemy known as the lecanium or soft scale has appeared in California from the Hawaiian Islands, and the State Board of Horticulture is up in arms, watching every steamer that lands and seizing every bundle of nursery stock as fast as it arrives. The Californians had a good lesson taught them when the San Jose scale was imported from Peru, fourteen years ago.

Protecting Fruit Trees.—In using blood on fruit trees to make rabbits sick and keep them from gnawing the bark, a beef liver is best and a swine liver is scarcely any good at all. One ox liver is sufficient to go over 2,000 small trees and an active man can go 1,500 trees in a day. Use a pair of old gloves in applying the liver and do not be finicky about the job. In our Colorado climate one application of ox liver will last four months ordinarily.

Creameries.—The Tempe, Arizona, Creamery is a very successful enterprise. It turns out over 300 pounds of butter daily, which meets with ready sale at the many towns and mining camps around. It is operated by a company composed of the leading farmers of the South Side and handles nearly all the milk product for miles around. The milk is bought at 70 cents per hundred pounds, and the butter brings an average of about 35 cents per pound. An ice plant is operated in connection, which supplies the towns of Tempe and Mesa City with ice.

European Fertilizing.—Impoverished land is now "vaccinated" on the continent of Europe. It is generally known that land is enriched by planting it occasionally with a leguminous crop, like clover or lucerne, the roots of which absorb more nitrogen than they take from the ground. Where the nitrogen came from was the problem. Messrs. Hellriegel and Willfarth have discovered that the absorption is due to a minute organism, a sort of disease in the roots, which, when the supply of nitrogen in the soil begins to fail, appear as an excrescence, draw nitrogen from the air, and so enrich the soil again. Experiments have been made in France and Germany to hasten the growth of the disease by sprinkling the fields with soil in which the tuberculous crops have been grown, or with water in which they have been steeped. In Prussia a field was sown with lupins; one part of it was then treated in the ordinary way, the other inoculated from an old lupin crop; the yield in the latter part was five and a half times as great as in the other.—*Farm and Fireside.*

Irrigating Raspberries. — The editor of the *Rural New Yorker,* who ought to know better, asks editorially if the irrigation of raspberries increases or decreases the ravages of anthracnose. As the irrigated raspberries of Colorado never had this disease we should infer that irrigation is not germane to the question.—*Exchange.*

A Dairy Cow's Record.—Mr. Chas. W. Nichols gives the record of one of his dairy cows as follows—Came in March 2, 1894. Total milk in 9 months, 8,700 pounds. Sold to the Tempe Creamery for $60.90—skimmed milk returned worth $6.60, and calf sold for $10, making a total return of $77.50 for the season. That shows what can be done with good cows on alfalfa.

Test for Starch in Potatoes.—Put a bushel of potatoes into a barrel nearly full of water, and stir in salt, the tubers of the lowest specific gravity, i. e., those poorest in starch, will rise to the top first. Pick

these off, and add a little more salt, when another lot will rise, and the bushel of potatoes can be readily assorted into different qualities. Potatoes containing the most starch, have the highest food value, and are the best for table use, because of being "mealy" when cooked.

Cherries in Nebraska.—By planting Dyehouse, Early Richmond, Early Morello, Large Montmorency, Ostheim, English Morello and Wragg, a constant succession may be obtained from June 5th to August 5th—two full months of ripe cherries.

Red Clover vs. Alfalfa.—A prominent farmer near Superior, Neb., after testing both in different localities states that red clover stands the drouth best and is preferable in other ways.

Susie:—"Papa, isn't it murder to kill a hog?" Papa (a lawyer):—"Not exactly. Murder is assaulting with intent to kill, the other is a killing with intent to salt."

Success is a wary thing. It can't be caught with chaff, nor by sitting and waiting for it accidentally to pass our way. He who seeks it must bait his hook with good, honest bait, and rise up early in the morning to drop his line in the stream of faithful endeavor.

Never grumble at what you can help; that's your own fault. Never grumble at what you can't help; that's not your fault. Ergo: Never grumble.

It is a great deal easier to do work when it ought to be done than to let it get behind even a day. Every day brings its own duties. If these are neglected, or if circumstances compel us to postpone them, we must work longer and harder to-morrow to catch up.

But few people think of the great number of our native flowering trees and shrubs which abound in nearly every State and county, and the use that might be made of them in decoration and ornamentation of the home grounds.

Recent experiments with Australian salt bush for the reclamation of alkali lands in California have been a success. The plant is said to grow luxuriantly on the strongest alkali soil, and live stock eat it readily.

Mr. Kinsell, foreman of Frank Devine's packing house has found a novel way of curing lemons, according to the following from the *California Enterprise:* He first carefully grades and selects the lemons, placing them in layers about three deep in large bins, and covers them with almost green alfalfa. The alfalfa sweats the lemons just right, causing them to assume a brilliant color and the rind to become pliable.

Near the end of the north piers of New York City is the large building of the Pure Food Product Co. They are engaged in manufacturing "cocoanut butter," and are turning out 5,000 pounds daily, and inside of a week their daily output will be 10,000 pounds. —*The American Creamery of N. Y.*

An Iowa dairy paper alleges that while fifteen to twenty-five cows are usually thought to be all that can be properly kept on an 80-acre farm, yet with plenty of alfalfa on a well irrigated farm the number may be increased to fifty or sixty head of cows.

Sin has many tools, but a lie is the handle that fits them all.

No greater mistake can be made in setting out olives than that of leaving two great a top on young trees. The olive ought to be planted for home use if a man owns only a single acre, for it equals the apple as a useful family tree.—*Orville Register.*

Apricots will be almost a total failure in Sonoma valley, (Cal.) this season. The trees commenced to blossom a week or two ago and gave promise of a good crop, but for some unknown cause they set in to bleeding and the blossoms dried up and fell off. The Bartlet tpear crop will be short, and it is the opinion of the owner of one of the finest pear orchards in this section that there will be only half a crop. Peaches and prunes promise well, and there will be a good crop of each.

Rock-a-bye, Lady Bird! on the tree top,
Eating the apples so green;
Catching the San Jose Scale on the hop,
Leaving the orchard all clean.

Lady Bird! Lady Bird! if you should fail
On the peach tree to be seen;
What shall we do with the San Jose scale?
Spray him with oil kerosene.

Good reports are coming into the California State Board of Horticulture regarding the mealy bug destroyer which has been distributed about the state recently. It proves to be a very efficient agent in ridding orchards of the pestilential mealy bug, and those having orchards affected by that pest should ask Professor Craw for a colony of his "Rough on Mealy Bugs"; we do not remember the name of it.

A remarkable slaughter of fish along the gulf coast of Texas by the cold weather of February is noted. It is estimated that in the shallow bays south of the mouth of the Brazos river fully 35,000 tons of fish perished from cold. The shores have been lined with dead fish for more than a month.

In Chicago to-day the retail meat markets are paying 8c. per pound for meat they bought for 4½c. last fall.

In traveling over Eastern Nebraska the absence of weeds is now favorably commented on. Is this a compensation for the partial failure of crops last season?

Mr. H. G. Hubbard, the entomologist of the Department of Agriculture, is authority for the statement that the cold weather which desolated the gardens and orange groves of Florida killed unnumbered millions of injurious insects. The young scale insects which had not passed their second molt were killed, although many eggs survive, and some adults of both sexes. The nitidulid beetles in decaying fruit were killed, small gnats in flowers were frozen, and not a living colony of plant-lice is to be seen on any orange or other tree. But for the fact that the destructive white fly (Aleyrodes Citri) infest the Cape jessamine as well as the orange, this pest would also be killed off; therefore Mr. Hubbard advises orange-growers to cut down and burn their jessamines.

THE QUESTION BOX.

The Question Box shall be an "open parliament" for the discussion of the practical, every-day questions that perplex the irrigation farmers. Questions will be answered by those men of long experience among our readers who are glad to give of their knowledge for the common good. Further answers are solicited from any reader whose experience differs from that published here. THE AGE reserves all rights of control of the department.

Pumping from Deep Wells.—A. F. S., Nebraska.—We have some rich table lands, but they are high, and the swells vary from 100 to 200 feet and more. Would like to irrigate, if only a garden spot. Can you give us the experience of those who have tried deep-well pumping? Give depth of well, size of cylinder and discharge pipe, power used, amount irrigated, and the success.

My pumping plant consists of a 7-inch 50-foot-deep well; 5x20-inch brass-lined Macdonald cylinder; 2½-inch discharge pipe; 12-foot Dandy Steel Wind Mill, and a reservoir 25x36 feet, four feet deep.

This plant watered 2¼ acres last season, when the rainfall amounted to but 5 3-16 inches from April 1 till November 1. We raised a variety of vegetables and fruits.

Used vegetables and fruits all we wanted in their season and canned fruits and kept vegetables to abundantly supply our wants until they are grown another season.

Vegetables sold $375.06; fruits $18.35; and in spring set strawberries, grapes, and other small fruits that gave no income, amounting to ⅞ of an acre. This plat is included in the 2¼ acres, total amount irrigated. J. F. GANSON, Lodge Pole, Neb.

Sweet Potatoes.—T. J. C., Kansas.—What is the best soil for sweet potatoes? They seem to be a profitable crop on a small scale. Would it pay to plant several acres? How are they cultivated?

1. The best soil for sweet potatoes is a rich, sandy loam moderately well drained.

2. Whether or not it will pay to grow sweet potatoes for market will depend entirely upon the local market. In a good town the grocers can always be depended upon to dispose of considerable. The best plan would probably be to canvass the market beforehand and see how large quantities are usually sold there. Sweet potatoes can be grown with less cost and greater certainty of a crop than common potatoes.

3. They are propagated by "slips" or sprouts produced by laying the sweet potatoes on a mild hotbed in April. The ground is thrown in ridges from three feet to three and a half feet apart and in the middle of May, when the weather is warm and settled, the sprouts pulled from the hotbed are planted on top of the ridges a foot and a half apart. If irrigation is practiced the soil should be well irrigated between the ridges immediately after planting. Cultivate when the soil is again dry enough to work, to prevent the formation of a crust; repeat this every two or three weeks until the vines cover the ground to such an extent that cultivation is no longer practicable. The potatoes form chiefly in September and October and should be dug as soon as nipped by frost. Two hundred bushels per acre is but a moderate yield. There is much difference in the quality of varieties; the coarse and less desirable kinds yield the most. Those which cannot be sold for human consumption can be fed to advantage to cattle and swine.

C. C. GEORGESON, Kansas Experiment Station.

The best soil for sweet potatoes is a warm sandy loam. They will do well in very sandy soil. The sweet potato crop is one of the best to grow year after year as a specialty, provided, of course, a market is in reach. We have a number of growers who raise from one to ten acres, each, per year, and they have made it pay, though Denver is our best market, over 300 miles distant. Our sweet potatoes are shipped as far west as Utah. Set the plants 16 inches to 18 inches apart in good, high ridges thrown up by stirring plow. It is an advantage if the ridges are thrown up some time previous to planting, so as to be settled and firm, as well as mellow, at planting. With a hoe or "spud" make a good-sized cup for each plant, in setting, and pour it full of water; then when the bottom of the cup is soft mud put the ends of your fingers on the end of the root of the plant and shove it down in the mud. Let it stand a little while and draw some loose dirt about the plant. Set in this way, every one will live without shading. Keep the ridges mellow and clear of weeds and irrigate between. It is very convenient to let the water into alternate furrows in setting plants, as the workers pass along the dry furrows and dip up the water from the opposite side of the ridge.

J. W. GREGORY, Garden City, Kansas.

Sweet potatoes require a warm sandy soil to do the best. They are raised about here by the hundreds of acres. They do not require a great amount of irrigation. The plants are raised in a hotbed and want to be ready to transplant here from May 10 to 20, to get best results. The ridges are thrown up with a two-horse stirring plow by throwing two furrows together, making the rows 3½ feet to 4 feet apart. Smooth off the top of the ridge and set plants about 6 inches apart. It takes from 7,000 to 9,000 plants per acre. As fast as the plants are set out a boy comes along and puts about a quart of water on each plant to settle the dirt around the roots and if the weather and ground are dry we turn water between the rows and fill the furrows one-half or two-thirds full to give the plants a good start. Then keep the weeds out by shallow cultivation until the vines begin to run. Then take a Lister or a Diamond plow, throw the dirt to the plants, ridging them well, and when the potatoes begin to set on give them another good irrigation, but do not let the water over the rows. In this way we raise from 150 bushels to 300 bushels of fine potatoes per acre. They are a profitable crop here under pump irrigation. LEE L. DOTY,
Garden City, Kan.

"What on earth are you doing with that little watering can, Tom?"

"Spwinkling the baby's head so's his hair'll sprout."
—*Harper's Young People.*

Those who make it a point to do a little more than they agree to do are scarce. Be careful what you promise to do, and then do a little more than you promised.

"One thing is certain that if you desire improvement in anything, it will never come to you accidentally. It must begin in a distinct, resolved purpose to make a change for the better.—*Ephraim Peabody.*

MAXIMS FOR THE IRRIGATED FARM.

Look out for Number 2 – your wife.

Keep an eye on the man under your own hat.

A short road to wealth is seldom safe to travel.

He is always a slave who lives beyond his means.

The true joy of reward is in the labor which wins it.

Don't try to grow profitable crops on impoverished soil.

It is an easy thing for a lazy man to overwork himself.

A "gold brick" deal always has a rascal on both sides.

Tickling the earth causes the fields to laugh with crops.

Most people enjoy the music of interest bearing notes.

One never grows fat by having to eat his own words.

It costs just as much to harvest a poor crop as a good one.

The man with a grievance is often a grievance to his friends.

The easiest way to appear wise is to keep your mouth shut.

It is much easier to hatch ideas than to bring them to maturity.

A plant that won't stand shallow cultivation—the human mind.

The toe of your boot is not a good thing to caress your cow with.

You would'nt irrigate a wet swamp; or use nitrogen on a clover crop.

A trifling dog is generally not half as trifling as the man who keeps him.

A sluggard is a fellow who takes the hardest way to have an easy time.

A man's life is too short to learn by his own practice all that needs to be known.

Who can give to another the hind-sight he has had so roughly ground into him?

Most of us have all the moral courage we want, but not half as much as we need.

Out of nothing comes nothing. If you do not feed the soil it will not long feed you.

The gossip resembles the bee, in that she is always busy, and carries a sting in her tale.

Don't sit down and wait for your crop to grow. It has got to be "raised" by manual labor.

The best way for a man to get out of a lowly position is to be conspicuously effective in it.

Many men, if they possessed a "title clear to a mansion in the skies" would mortgage it.

I never enjoy a man's theories about the government w l o cannot manage a ten-acre patch.

A *bulge* on a meat-can indicates something wrong inside, the same as with heads or—stomachs!

Don't sow alfalfa in your orchard unless you want to kill the trees. The experiment has been tried.

The worm in the whisky distillery will do more damage to the farmer this summer than the cutworm.

The water that makes the foam under the mill dam, is not the water that turns the wheel of the mill.

The stalk of corn that grows the tallest and appears the most conspicuous nearly always bears a blasted ear.

He who plants a melon patch too near the public highway can scarcely be regarded as a promoter of public morals.

The man who never speaks gently to his horses is the same man who never speaks kindly to his wife, or to his children.

The pear-leaf blight is caused by a minute parasitic fungus. Spraying with (the new) Bordeaux mixture is a sure remedy.

It is easier to formulate a system of national finance than to earn an honest dollar. Honest dollars are only made by hard work.

Would you deprive your children of the keen enjoyment you have experienced in building up a home of your own by giving them one already built?

Both in art and in practical life one should avoid a blind worship of the extraordinary; we too often bestow admiration when only curiosity is called for.

Men are aided by books and papers treating upon their vocation, but reading alone will not fit one for doing any great work. Neither will a friend's advice.

Its the condition of the peach buds rather than the cold that determines the peach crop. Its *you* rather than your circumstances that determine your life's crop.

Said an ex-drunkard while enjoying "a pipe," "I am a brand plucked from the burning." "Anybody might know that," said the old lady, "for you're smokin' yet!"

Have you read the article on how to tell a bad egg? "No, I haven't, but my advice would be, if you have anything important to tell about a bad egg, why break it gently."

If you had to believe all that other people say in their own favor, you would soon be obliged to do some lying on your own account, or else fall behind in the procession.

You needn't take a man's word for it that he has dropped from the clouds, because there is no dust on his shoes. May be his wife blacked them before he was up in the morning.

When a stranger treads on your toes, who does not feel as did the German who said, "Mine frient, I know mine feet vas meant walking on, but dot brivilege belongs to me"?

PULSE OF THE IRRIGATION INDUSTRY.

SECRETARY COBURN OF KANSAS.

THE quarterly report of the Kansas State Board of Agriculture, issued March 31, 1895, is a very valuable contribution to the industrial literature of the West. It deals principally with four topics—alfalfa, irrigation, well-water supply and sub-soiling—although it presents incidentally valuable information upon many other subjects. In manner of arrangement, and in typographical beauty, as well as in the matter of its contents, this report is one of the most valuable which has been published in the West, and it ought to be in all farmers' libraries.

This is a good occasion to speak personally of Hon. F. D. Coburn, the secretary of the State Board of Agriculture, and secretary and treasurer of the new State Board of Irrigation. Mr. Coburn is certainly one of the most useful men in the public life of the West to-day. Like all men who accomplish much for the public, he is an enthusiast. He believes in Kansas and irrigation. He is becoming more and more an aggressive force in the industrial life of Kansas.

Secretary Coburn was born in Wisconsin, and descended from the Yankees of New England and the Dutch of New York on his father's and mother's side, respectively. He did not have many early advantages in the way of schooling, but has had a varied experience in the practical side of life. At the age of 17, he ran away from home to enlist in the Union army. After the war he went to Kansas, and began life in the then new State under very humble circumstances. Next, he taught school, and then went into business for himself, dealing in cattle and land and gradually acquiring a comfortable independence.

Secretary Coburn has made a great study of Kansas agricultural problems, and in 1880 was invited to accept a position in the State Board of Agriculture, of which he later became secretary. He has also contributed much to current agricultural literature, and for some years was editor of the Kansas City *Live Stock Indicator*. He also preceded Senator Peffer as editor of the *Kansas Farmer*. The publication of a book entitled "Swine Husbandry" in 1877 made Secretary Coburn a prime authority on that subject.

The recent act of the Kansas Legislature providing for a State Board of Irrigation opens a new chapter in the history of that State. As secretary of this board it is to be expected that Mr. Coburn will render a most important public service, possibly the best of his life. He certainly has an opportunity to do so, and he is the sort man to utilize it.

While having faith in the possibilities and beneficence of irrigation in his State, even upon the higher lands, Mr. Coburn persistently maintains that for the masses the greater essential to a more successful agriculture is a better conservation of the rain waters by means of sub-soiling; making more receptive and retentive the compacted, impervious prairies by their deeper stirring, breaking-up, and more thorough tillage. In other words, he thinks that in the business of most Kansas farmers irrigation is to be regarded as merely an adjunct rather than a main dependence.

A very good portrait of Secretary Coburn is published elsewhere in this number of THE AGE.

IRRIGATION IN "THE CENTURY MAGAZINE."

THE *Century Magazine* for May contains an article of fifteen pages, by the editor of THE IRRIGATION AGE, entitled, "The Conquest of Arid America." The article is beautifully illustrated with drawings by Harry Fenn, Mary Hallock Foote, and other famous artists. It also contains maps and diagrams. The importance of the article consists in the fact that the greatest of American magazines has given a generous recognition to the Western cause. This is simply more evidence of the phenomenal rise of the subject to popular interest and of its recognition in the most influential quarters.

It must be perfectly plain to all who have followed the developments of recent months, that the time has come when the making of new institutions in the Great West can be begun on a large scale and swiftly carried forward. All that is required is to devise plans that satisfy the popular needs, and to provide land upon terms which homeseekers can meet.

THE HOMESEEKERS' ASSOCIATION.

THE Homeseekers' Association was organized by prominent clergymen of the city of Chicago for the purpose of furnishing reliable information in regard to the various lands which were opened to settlement by colonists, and in regard to lands which were in the hands of private companies and individuals and were offered for sale to emigrants.

As the clergy have more time than business men, they are better able to gather information in regard to any particular locality or community, and the information thus gathered can usually be relied upon as being very nearly correct. It is the intention of the association to expose fraudulent land schemes and to denounce boomers. They expect to be able to throw around the intending settler many safeguards, and thus protect him from the clutches of those whose only object is to secure what little money he may have and then leave him stranded.

The officers of the association are: Robert F. Sulzer, President; Rev. C. E. Morse, Vice-President; R. R. Beam, Secretary; Rev. Dr. John Rusk, Corresponding Secretary; and Rev. W. H. Reynolds, Treasurer. The Directors are Rev. Geo. A. Mitchell, Dr. H. W. Thomas, Rev. P. S. Henson, Father Ambrose Vretta, E. Erskine McMillen and Dr. J. W. Carr. The association has been endorsed by the newspapers of Chicago, and it is certainly doing a work that reflects great credit upon the gentlemen who have organized it, and it will also result greatly to the advantage of intending settlers. The address of the association is 821, Association Building, Chicago.

HOW TO ORGANIZE AN IRRIGATION COMPANY.

A correspondent asks for information as to the formation of an irrigation company; the toll, or rate, per acre usually charged; the amount of water required to irrigate a given amount of land; and other data that would assist in such an enterprise. He has one proposition of 5,000 acres, where it is estimated

the cost will be $20,000 for the construction of the ditch and securing water rights; and another of 12,000 acres, where the cost will be about $50,000. He adds that he wishes to enlist capital in the enterprise. The lands are adapted to the culture of deciduous fruits, and diversified farming and hops are especially profitable there. The list of questions propounded would require extended space to answer in full. The organization must be in compliance with the State laws. The next thing is to secure a board of directors that will command confidence. The next, and most important detail, is the employment of an engineer, whose competency is beyond question. No greater mistake is ever made than to employ engineers lacking experience and ability because there is a saving of salary. Better pay $5,000 or $10,000, according to the magnitude of the work, for an engineer who will make no mistakes, whose experience insures success from the moment the works are begun until they are completed and avoid those risks, than to pay twice or sometimes, five times as much for bad management, faulty location and blunders. With a legal organization, a good board of directors and a competent engineer, the company is in condition to invite capital. Wherever a water supply can be provided at a cost to the farmer of not exceeding $8 or $10 per acre for the prime cost of water right, and an annual rental of $1 or $1.25 a year, irrigation will always be justified, and with good management will be profitable. There are localities where special conditions justify a very much larger outlay, but diversified farming and deciduous fruit culture will justify such an outlay as is named if properly utilized.

UNDERFLOW OF RIVERS.

The Utah Experiment Station has issued a bulletin on "Seepage Waters and the Underflow of Rivers."

During the summer of 1894 many measurements were made of the canals and tributaries of Ogden and Weber rivers to determine, if possible, whether water could be diverted and applied to the surface of cultivated areas in the upper valleys without injury to the priority users in the lower valleys.

The preliminary investigations, which extended through July and August—a period much too brief on which to base accurate results—seem to demonstrate the accuracy of the following statements:

1. That the diversion of water from a stream and its application to the soil in the upper valleys in the early part of the irrigation season when water is abundant, increases the available supply to the irrigators of the lower valleys in the latter part of the season.

2. In most cases a time is reached, usually about midsummer, when no portion of the water diverted from the stream in the upper valleys reaches the lower irrigators in time to benefit them. Such diversion and use damage the irrigators of the lower valleys.

3. In some instances the outflow from the upper valleys during July and August was much greater than the inflow, although a large part of the inflow was used for irrigation purposes.

4. The behavior of irrigation waters in any drainage system can be determined only after a series of carefully made measurements extending over a period of years, and that much ill-feeling, trouble, and litigation would be avoided if the State would collect the necessary data.

ARIZONA.

New hay is on the market.

Grain crops are nearly all headed out.

The prospect is excellent for a large crop of fruit.

Strawberries beginning to come in, and apricots will be on the market by the first of May.

Mr. William Clark, the leading florist of Colorado Springs, is visiting Phœnix, looking into its floral resources and possibilities. It is probable that he will locate a branch of his establishment here, where flowers bloom the entire year and hot houses are unnecessary.

Cattle feeding in these valleys is a very profitable business. One instance is furnished Mr. Ben Goldman, of Tempe. On the 27th day of December, 1894, he bought 70 head of steers that weighed 72,692 pounds. The steers were sold the 22d day of March, 1895 and weighed 83,915 pounds, a gain of 11,223 pounds in 85 days, or nearly two pounds per head per day. The net cash gain was $543. This is a record hard to beat, and shows what can be done with cattle on alfalfa.

Since the advent of the new railroad the price of lumber has dropped $10 per thousand all around. The result is easily seen in the increased number of buildings being erected on every side. Still, there are very few vacant houses, and not one unoccupied room on either side of Washington street—the main business street of Phoenix.

The Yuma Improvement Co. are about to begin work on a pumping and gravity system that will cover 70,000 acres of fine land just below the town of Yuma.

Arizonans ought to appreciate their own University, when they are told that Professor William P. Blake, the noted mining engineer, has placed his son there as a student, and that a civil engineer who has had good training in Princeton University has registered as a special student under Professor Boggs. Several students have pursued courses in assaying in the School of Mines, largely under Professor Goodloe's care, and one of them is now the assistant superintendent of a prominent California mining company. The men and the equipment of the University of Arizona are of the best, and these are what constitute the worth of such an institution.

CALIFORNIA.

There is a boom in alfalfa culture about Winchester.

It is expected that a sorghum mill will be put in at Hemet.

The berry growers of Azusa, Glendora and Covina have organized an association and will do all their packing at a central warehouse.

The South Riverside Land and Water Company has begun work leveling down the banks of the canal through Elsinore.

This is the season of the orange blossom, and from all over Southern California there ascends to Pomona and to Flora incense as sweet as ever greeted the senses of a goddess.

The case of the Vernon Irrigation Co. against the city of Los Angeles, has been decided in favor of the company, and therefore some anxiety has been aroused as to the effect upon the city's right to use all the water of the river. The decision of the court

is that the city has no right to take water from the river outside the city limits, and sell or dispose of it. The city has been selling this water for forty years and if this decision stands it will mean a net loss of $25,000 a year. It is expected that the city will file a petition for a rehearing.

The *News* says that the Hemet Company has just received the first order of 3,000 barrels of cement to be used in the extension of the Hemet dam to its projected height of 150 feet. The cement has just been unloaded at San Pedro, and will arrive at Hemet shortly. Work will commence at the dam as soon as good weather is assured.

COLORADO.

The High Land Canal & Reservoir Company are crowding the surveying of their new ditch. With the help of J. H. Hougaard they have run the preliminary line, and find nearly 2,000 acres more land under the ditch than they expected, which is still open for location.

Engineer E. E. Baker estimates that there is not far from 20,000 yards of dirt to be moved on the Fort Morgan canal extension. This, we suppose, is in addition to the fill approaches to the flume.—*Fort Morgan Times.*

KANSAS.

Dr. B. R. Mosher, of Kinsley, has his irrigating pump in operation, and it is pronounced a success by those who have viewed and investigated the plant.

Grant county boasts of an irrigating ditch four miles long; Hamilton county has over twenty miles in operation and about the same distance under process of construction.

The dry weather is causing the farmers not under irrigation to feel discouraged, fearing another crop failure.

I. L. Diesem has been appointed fish warden for Finney county. Mr. Diesem lately shipped two consignments of fish from his reservoirs to parties in Edwards county.

Every indication so far points to another failure for Western Kansas, although it may be too early yet to form definite conclusions, writes Presley I. Lancaster. My experience with sowing grain in the dust has been a dear one, and I have determined to take no more chances in that line, and therefore, look askance upon the dust fields this year. We have the cold winter in our favor, for such winters are almost invariably followed by large harvests, and then we can hardly expect three complete failures in succession. But poor, indeed, is the present outlook.

A failure this year would really be for the permanent bettering of Western Kansas. It would convince the last settler that we were once and for all "short" on rain, and would put the country on an immediate irrigation and stock-raising basis. The "divide" settlers have been here nine years. They have spent their own nest eggs, the mortgage they made at "proving" up time, and the chattel loans on their stock and implements. Now, it is plain to me that they will never get up again, never pay interest on their debts even, by farming in the old way. Give them a crop this year, let them pay out of this their share for seed, the expense for grain and hay, their grocery bill, and I don't believe one out of ten will have seed enough for next season. That is apt to be a failure, and again the same thing of aid, aid, aid. Three in nine years: '90, '92 and '93.

The sooner we get at irrigating on every 160 acres the sooner will we be above dependence or aid, the sooner will the mortgages be paid, and the sooner will we raise the name of this coyote country from that of public pauperism into one as fair and creditable as that of Southern California.

Irrigation, hogs and alfalfa; these are our rainmakers and gold makers.

MONTANA.

A corporation has been organized at Glasgow by the representative business men with a capital stock of $200,000 under the name of the Montana Irrigation and Land Company, for the purpose of irrigating and reclaiming the arid lands of Valley county, with the construction of the necessary irrigation canals and a system of storage reservoirs, with the following executive officers: J. L. Truscott, president; Chas. E. Hall, vice-president; M. D. Hoyt, secretary; Frank Lemmer, treasurer and A. W. Mahon, chief engineer.

NEW MEXICO.

The final location is being made of the two-hundred-mile extension of the Pecos Valley Railway from Roswell northeasterly to a connection with the Santa Fé system and the Denver & Ft. Worth Railway at Washburn or Amarillo, in the Texas Panhandle.

The farmers of the Pecos Valley are becoming much interested in the cultivation of sugar beet. Analyses of beets raised in various parts of the valley last season show that they run remarkably high in saccharine matter and purity, while the yields per acre border on the phenomenal. A beet sugar factory in the Pecos Valley is doubtless a question of a short time only.

The splendid fertility of the soil, added to the miles upon miles of irrigating canal should prove sufficiently seductive to induce the farmer to leave his mortgage-burdened farm in the East for a few acres in the Pecos valley.

SOUTH DAKOTA.

There are about twenty-five or thirty artesian wells in Bon Homme county, South Dakota. Many of them are of small size—1½ to 3 inches—used principally for stock, although some water is used for irrigation. There are two fine fish ponds which get their supply of water from the artesian wells. There are also two large wells at Springfield; one 8-inch that supplies power for a 60-barrel flour mill, and one 4-inch used for city purposes.

TEXAS.

The White River Land and Irrigation Company, of Plainview, Texas, has been incorporated, with G. M. Slaughter, president, and R. P. Smythe, general manager.

WASHINGTON.

The Entiat Irrigation Company, of Waterville, Wash., has commenced work on a large irrigating ditch, taking water from the Entiat river near where it empties into the Columbia, and reclaiming several thousand acres of land especially valuable for fruit raising.

Arrangements have now been completed for the permanent exhibit which the State of Washington has been expecting to have in Chicago. Mrs. Alice Houghton, to whose untiring efforts credit is due for this work, says that within about a month the exhibit will be installed. It is to consist of fruits, grains and other agricultural and horticultural products and minerals, as well as maps and diagrams and photographs of everything relating to Washington.

The Pennsylvania *Farmer* urges the importance of irrigation in Pennsylvania, either by means of running streams or windmills.

ASSOCIATED ENGINEERING SOCIETIES.

The Association of Engineering Societies publishes a monthly journal which contains the proceedings and papers of the societies and an index to current technical literature. The aggregate membership of the associated societies is now nearly 1,500, and Mr. John C. Trautwine, of 416 Locust street, Philadelphia, is secretary.

ENGINEERS' ANNUAL.

The review of the Irrigation Engineers' Annual in a recent number attracted much attention, and many requests for copies have been made. Mr. John S. Titcomb, the secretary of the Society, Room 36, Jacobson building, Denver, informs us that the Annual is for free distribution only among members of the society. To all others the price is $1 each.

WEATHER CROP BULLETINS.

The National Weather Bureau and the State Weather services throughout the country collect and publish in bulletin form, from week to week during the season of planting, cultivating and harvesting of crops, prevailing weather conditions and their effect upon farming operations and crops. Both State and National bulletins are issued on Tuesday. The National bulletin treating of the general weather and crop condition of the whole country, while the State bulletins give detailed information concerning the weather and its effects upon the various staples of the several States. The National bulletin can be obtained by writing to Mark W. Harrington, Chief of the Bureau, Washington, D. C., and the State bulletins from the observers located in the various States.

WESTERN SOCIETY OF ENGINEERS.

The Western Society of Engineers has devoted considerable attention to irrigation during the past year, and since they moved into their large, elegant quarters in the Monadnock Block they have made many additions to their library on this subject. This society is in a strong and flourishing condition, having a great many prominent men among its members. They hold meetings frequently, at which technical subjects are discussed and papers delivered by men high in the profession. But they do not lose sight of the society side, and therefore have entertainments and suppers as often as possible. During the summer the excursion committee arranges for trips to all the notable points of interest within fifty miles of the city. This system was inaugurated during the World's Fair, when so many visiting societies were in the city, and it has proved to be one of the most pleasant features of the society's program.

The library is a technical one, and includes books on all the various branches of the profession. It is growing very rapidly under the able management of Mr. Chas. J. Roney, secretary and librarian, and in time Mr. Roney expects it will be one of the best technical libraries in existence. The society's address is 1635, Monadnock Block, Chicago.

CLAY TILING.

OSBORNE, KAN., February 4, 1895.

W. S. DICKEY CLAY MFG. CO., Kansas City, Mo.

Sirs: Yours of the 2d at hand, and will say in reply that I am *more* than satisfied with my sub-irrigation plant. I have been running my pump all winter, and have my three acres all soaked up and in fine shape for gardening in the spring. Last spring I put in 300 feet of tiling, and I found that I could raise anything I planted. Some say it is too expensive. My garden is in town, and if I had to build a reservoir on it the land that I would have to use for that purpose would almost buy the tiling. As I pump direct into the tiling, this does away with the reservoirs.

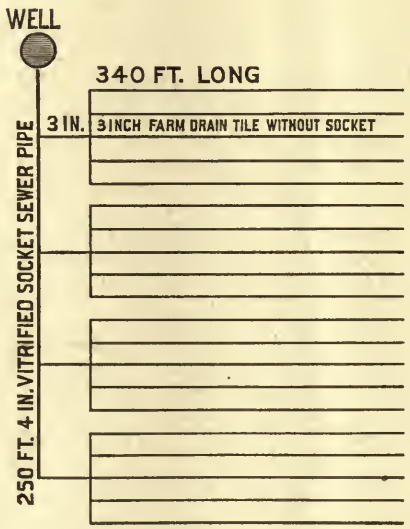


DIAGRAM OF ARRANGEMENT OF TILING.

I have my tiling so arranged that I can wet any part of my garden whenever I choose. My tiling (3-inch) is laid 16 inches deep, and the moisture comes up to the top when thoroughly soaked. I have a well 43 feet deep. I use a 5-inch pump and a 12-foot mill. I can lift 800 barrels per day, and there is no evaporation as it pumps direct into the tiling.

I want a car of tiling in the spring for my neighbors. What can you lay me down 3 and 4-inch tiling F.O.B Osborne for? Any inquiries directed to me concerning sub-irrigation will be answered.

Yours, ANDREW LINN.

THEORY OF TURBINES.

J. Wiley & Sons, of New York, have published a very comprehensive treastise on turbines by De Volson Wood. It deals with the subject in an exhaustive manner and is illustrated with many diagrams and cuts. It also contains many tables which are of great value to the engineer. Price, in cloth, $1.00. J. Wiley & Sons, 53 East Tenth Street, New York City.

ART IDOLS.

"Art Idols of the Paris Salon," published quarterly by the White City Art Publishing Company, 319 Dearborn street, Chicago. Price $1 a number, $4 per year. We have received the second number of the "Art Idols of the Paris Salon," a publication that does credit to the publisher in his ideal of the practical production of the old masters and the modern efforts of the new. The illustrations are handsomely executed and the letterpress shows the touch of genius. In this age of art we hope the publisher will realize all his hopes have painted.—*San Francisco News Letter.*

WANTED A FAIRY STORY.

Little Johnny—Tell us a story, uncle.

Uncle Wayback (from the West)—All right, children. You want a true story, I s'pose.

Little Johnny—No, tell us one of those fairy stories about cyclones, and grasshoppers, and things you were telling the company last evening.—*Good News.*

DREDGES AND SHOVELS.

The Marion Steam Shovel Company are the manufacturers of a line of steam shovels, ditching dredges and ballast unloaders capable of performing almost any service required, and they are the best of their kind on the market. The building of large canals and dams necessitates the excavation of thousands of yards of earth and rock, and experience has shown that a steam shovel or dredge is the most economical way of accomplishing this. The Marion Steam Shovel Company have been engaged in the manufacture of this class of machinery for many years, and bring to it a long experience and a thorough practical knowledge of the requirements of the business. Their factory at Marion, Ohio, is a very large one, covering several acres of ground. An illustrated catalogue, giving a full description of their machinery, will be sent upon application.

PUMPING TWO HUNDRED THOUSAND GALLONS.

SYRACUSE, KAN., March 14, 1895.

WEBER GAS AND GASOLINE ENGINE CO., Kansas City, Mo.

Gentlemen: You have no doubt wondered why we did not answer your letter, but we did not want to write you till we had made thorough tests of the engine. We have now thoroughly tested the No. 4 Engine bought of you last September, and stand responsible for what we say, and we can say truthfully that it will do all and more than you recommend it to do.

We raise 200,000 gallons per hour seven feet high, using a Menge pump, and can irrigate twelve to fifteen acres of land a day. We use one gallon of gasoline per hour, costing us 13c.

We invite the public to come and see our plant in operation, and stand ready to answer all questions We heartily recommend your engine to any and everyone who thinks of putting in an irrigation plant.

When it comes to WATER we are independent of everyone now, and it would be impossible for us to say too much for the "WEBER," and if you want to shape up a testimonial letter from us you have our full permission to do so. You cannot exaggerate the work of the "WEBER."

Wishing you success, we are,

Respectfully, H. C. PRICE & BRO.

Per H. C. PRICE.

RECENT LEGAL DECISIONS.

What Constitutes Appropriation.—One who, in California, desires to appropriate the water of a stream upon the vacant and unappropriated public lands of the United States for a useful purpose, may do so by the construction of a ditch or other medium of conduit, and actually appropriating the water and conducting it to some point where it can be utilized in fulfillment of such useful purpose; and by so doing he acquires as against all subsequent appropriators and riparian proprietors acquiring title from the United States subsequent to such appropriation, the right to the quantity of water thus appropriated, and an easement of right of way into and over the public land traversed by his ditch or conduit so constructed and used for such purpose. If one animated by a like desire to appropriate water under like circumstances finds a ditch already constructed to hand, takes peaceable possession of same, and appropriates the water for a like or similar useful purpose, he thereby acquires a like right as against all the world, except the true owner, or those holding under or through him. To the owner of a ditch thus possessed and used, such appropriator must account until his possession ripens into a title by prescription or adverse user. His right in such case will depend for priority, as against other appropriators of water from the same stream, upon the date of his possession and appropriation, and not upon the date of the original construction of the ditch and appropriation by some other person under whom he does not hold, and between whom and himself there is no privity of estate. His appropriation in such a case is a new and independent one, and must stand or fall upon its own merits.

Utt v. Frey. (Supreme Court of California.) 39 Pac. Rep., 808.

What Constitutes Abandonment.—The right which is acquired to the use of water by appropriation may be lost by abandonment. To abandon such right is to relinquish possession without any present intention to re-possess. To constitute such abandonment, there must be a concurrence of act and intent, viz.: the act of leaving the premises or property vacant, so that it may be appropriated by the next comer, and the intention of not returning. The mere intention to abandon, if not coupled with yielding up possession or accessation of user, is not sufficient; nor will the non-user alone, without an intention to abandon, be held to amount to an abandonment. Abandonment is a question of fact to be determined by a jury or the court sitting as such. Yielding up possession and non-user is evidence of abandonment, and, under many circumstances, sufficient to warrant the deduction of the ultimate fact of abandonment. But it may be rebutted by any evidence which shows that notwithstanding such non-user or want of possession, the owner did not intend to abandon.

Utt v. Frey. (Supreme Court of California.) 39 Pac. Rep., 897.

Action to Re-Enjoin Interference With Right to Use Waters.—That the water of certain springs was liable to appropriation, and that one appropriated it, is sufficiently averred in a complaint to enjoin another from interfering with his right to use the water from his mine and mill, where it alleges that the land on which the springs were situated was government land; that no one was in actual possession; that he took possession of the water and springs by entering on the land, and constructing the necessary ditches, reservoirs, and pipe line to conduct the water to his mill; and that he has used it adversely for more than five years. Under a complaint to restrain the interference with his alleged right to the use of water, alleging appropriation by entry on public land, and a prescriptive right by use for five years, evidence is inadmissable that he acquired a right to take water by the permission of persons who had previously applied to purchase the land from the State, and whose application had been approved.

Public lands selected by the State in lieu of school lands is not lands belonging to the United States, in such a sense that a water right by appropriation may be acquired at any time before the issuance of a patent, notwithstanding its occupancy by one who has made application for its purchase from the State.

Shenandoah Mining & Milling Co. v. Morgan. (Supreme Court of California.) 39 Pac. Rep., 802.



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Standard Singers - $8.00, $11.00
$15.00, and 27 other styles. All attachments FREE. We pay freight ship anywhere on 30 days free trial, in any home without asking one cent in advance. Buy from factory. Save agents large profits. Over 100,000 in use. Catalogue and testimonials Free. Write at once. Address (in full), CASH BUYERS' UNION, 158-164 West Van Buren St., B 120, Chicago, Ill.

GRAND CANYON OF COLORADO RIVER

On the Santa Fe route, in Northern Arizona, 1,262 miles from Kansas City, is the town of Flagstaff. A tri-weekly stage line runs from Flagstaff to the Grand Canyon of the Colorado River. More than a mile in depth, this is the sublimest of gorges—a Titan of chasms. Twenty Yosemites might be hidden unseen below, and Niagara would look scarcely larger than a brook.

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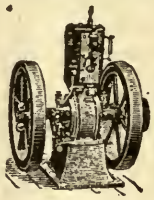
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THE IRRIGATION AGE.

VOL. VIII. CHICAGO, JUNE, 1895. No. 6.

THE PROGRESS OF WESTERN AMERICA.

Silver Dominant. The writer devoted the month of May to a somewhat extended tour of the arid States. Hence these notes of western progress were obtained from personal observation rather than from correspondence and newspapers. For the last several years silver has been the rising question throughout Western America. To-day it is the dominant and all-absorbing topic of discussion. Newspapers and conventions teem with it. On the trains and in the hotels almost nothing is talked except the chances of a silver victory in 1896. Every late comer from the East is besieged with anxious inquiries about the political outlook. In these days there are two things that can be seen on every hand, wherever one goes, from the Atlantic to the Pacific—bicycles and Coin's Financial School. But neither of these subjects immediately concern the readers of THE AGE.

Golden Speech at Denver. Irrigation interest is not conspicuous in Denver. Strangely enough, neither is silver. In Denver the atmosphere is laden with gold. Everybody has just taken $1,000,000 out of a gold mine, or is just upon the point of doing so. It may be that there are people in Colorado who have tried to find a gold mine and failed. If so, they are never heard of. One only hears talk about those who have succeeded. He looks in one direction and sees a woman who drew $1,000 in a lottery, improved a gold claim, sold it for $2,000,000, and now lives in luxury in the gay capital of Colorado. Looking in another direction, one sees an opulent individual starting for California in a private car, and is told that only the day before yesterday this man was a poor carpenter, doing odd jobs at Colorado Springs. In such an atmosphere as this, irrigation would be a very prosaic subject for discussion. The writer was not surprised to find very little interest in Denver concerning the recent State legislation accepting the benefits of the Carey law. As a matter of fact, no effort is being made to utilize the law and inquirers are discouraged by State officials with the statement that there are no chances to reclaim land under this law. But if there is no interest in such matters at Denver the case is different on the glorious Western slope, down in the broad valley of the Grand.



A. H. FORD,
Of the Homeseeker's Journal, Chicago, Ill.

The Grand Valley. If one were called upon to name the very best valley in the West, and threatened with a heavy penalty if he erred in his judgment, he would find it very difficult indeed to fix his choice. There are many beautiful valleys, each with its peculiar advantages, always offset by certain disadvantages. The person who should attempt to decide this delicate question would be in the position of the lover who exclaimed, "How happy I could be

with either, were t'other dear charmer away." But certainly the Grand Valley in Colorado would be dangerously near the top. The thing for the settler to determine, is to find the place where the chance of prosperity in the long run, taking it over a series of years, is best. In Western Colorado the equilibrium between production and consumption is likely to be better maintained than is possible almost anywhere else in the world. The amount of good land that can be watered is comparatively small, while the surrounding home markets are already very large and constantly increasing, as they must continue to do for many years. The soil is wonderfully rich, and the water supply abundant and unfailing. Many a traveler has looked at the big desert around Grand Junction and scoffed. In his ignorance he regarded it as waste land. It is destined to be one of the fairest gardens on earth, and the process of transformation is well begun. This is pre-eminently a fruit country. It is all but semi-tropical in climate. It produces the delicate fruits, and the writer was surprised to observe a man from California planting quite an acreage to English walnuts.

Developing Under Hard Conditions. But one cannot look upon such a valley as this without a keen realization of the folly and injustice of our governmental policy. Here is a tract of 100,000 acres which, until quite recently, was government land. Two great rivers, the Grand and the Gunnison, furnish water for it. The moment a canal is undertaken speculators rush in and take up the land, which they are neither able or disposed to improve. Their purpose is to take advantage of the private enterprise which is to reclaim the land and profit by selling out to actual settlers. The settlers do not come. Thus the irrigation enterprise is a failure. The first extensive canal built here involved a very large loss for the investors. There was nothing the matter with the country or climate, and there was a large demand for land, but private enterprise could not control the situation, and the speculator held the land at preposterous figures. On both sides of this magnificent valley men with very little means are struggling to develop new enterprises, and the owners of large bodies of land are waiting anxiously for the outcome. Thus the development of the valley halts and falters, when under proper conditions it would rapidly go forward and homes would be made for perhaps 100,000 people.

What Might Have Been. If the Grand Valley had been located in France, Spain, Italy, Egypt, India or Australia it is altogether likely the case would have been entirely different. The land would not have been open to settlement at all until reclaimed. The government would have expended $1,000,000 or $2,000,000 and reached out two strong arms, in the shape of large canals, one on either side of the valley. It would then have opened the land to settlement in small tracts, probably not exceeding twenty acres, at the actual cost of reclamation, which would be from $5 to $10 per acre. The government would have been quickly repaid by direct return from water rights and the people of the valley left to administer the systems, as they do their other public affairs. If this were the situation to-day in the Grand Valley the railroads would be taxed with passenger traffic, and in a few years this would be one of the most populous and prosperous localities on the continent. As it is, the valley must work out its results by a slow and painful process, the settler paying unreasonable profits to the remorseless speculator, and the water supply being in the hands of private parties, who expect to levy tribute forever upon the industry of the producer. This is the way the American people render themselves ridiculous by comparison with the enlightened peoples of countries on which they look down with fine scorn. But in spite of these mistakes and drawbacks the Grand Valley is making progress. It has enjoyed a considerable increase in population this year. The fame of peach day at Grand Junction still travels, and the latest acquisition of this enterprising community is natural gas. The whole locality presents a fine field for development. If the settler has the money to pay the prices asked for the land, there is every reason to believe he can prosper.

The New Utah Constitution. Irrigation and settlement is making quite rapid strides in Utah. But the subject was neglected to a deplorable extent in the new constitution. The friends of irrigation anticipated no difficulty in having the new State claim jurisdiction over all the waters flowing within its boundaries. To their surprise, the cry was raised that this would amount to the confiscation of all water rights, and the convention hastily proceeded to defeat the proposition. Hence Utah's neighbors need look for no trouble from her on interstate questions. They are at perfect liberty to absorb all the water they want and apply it to a beneficial use. Utah has no constitutional grounds on which to stand in defense of her own appropriators. Now, if Utah were only Colorado, Kansas and New Mexico would find very little obstruction to their claim to the natural flow of the Arkansas and Rio Grande. But a matter of more immediate and pressing misfortune was the failure of the constitution-makers to provide Utah with a State administrative system. No State is more sorely in need of a State Engineer, who shall enforce the proper use of water and supervise the operation and construction of irrigation works. It seems strange that Nebraska should have an engineer, while Utah has none to attend to her complex and important irrigation interests. But it is some

satisfaction to reflect that the Legislature can make amends for the neglect of the convention to some degree.

Mormon Object Lesson. The little farms of Utah are looking very bright and prosperous this spring. Early in May the orchards were laden with blossoms and the garden stuff was beginning to make



JOEL SHOEMAKER,
Manti, Utah.

straight green lines on the black soil. The alfalfa, or lucern, as it is always called there, had begun to paint the valleys with its deep green tint. Fat horses and cows loafed comfortably about the barnyards in the little agricultural villages. As usual, there will be no empty stomachs among the sovereign laborers of Utah who work for themselves. The figures of Mormon earnings, published in the *Century Magazine* for May, have called out some letters which dispute the showing. These figures were furnished by the church authorities, and were given for what they are worth. But in considering the Utah experience there is no need of disputing about figures. The simple facts are luminous. Everybody knows that these people carved out 10,000 small farms from the virgin desert, having almost no capital except their labor. Everybody knows that the cost of their canals, stores, factories, banks, railroads, telegraphs, churches, temples and missionaries, as well as the stupendous item of the living of all these people for forty years, came from irrigated soil. A few millions more or less are not important. The great fact is that these people started practically without capital and have prospered and multiplied. Their experience constitutes the stupendous object lesson—the unanswerable argument—which Arid America shows to the world at this time, when there is so fierce a demand for labor and homes for the masses. Those who quibble about figures lose sight of the larger consideration.

Nevada's Strange Delusion. Nevada has the smallest population of any State in the Union. It is the only State west of the Allegheny mountains which has ever shown a record of decreasing population. And yet perhaps no State could more easily develop its resources and swell the number of its inhabitants. The greatest lack in Nevada is the lack of public spirit. It has been said so many times that the State is worthless that a large majority of its people appear to believe it. The strangest thing about the whole matter is, that everybody thinks the restoration of her prosperity is to be secured only by the revival of the old mining activity, and yet any one who takes this view, must shut his eyes to facts written in legible characters upon every page of Nevada's history. Such prosperity as the mining industry alone can confer upon a State Nevada has enjoyed beyond all other localities. Did it make her rich? No, it made her poor. Her wealth was steadily drained to build palaces in San Francisco, New York and London, and to recruit the waning fortunes of unworthy foreign aristocrats. The world needs both precious metals, but mining made Nevada neither rich, nor populous, nor respected. And yet Nevadans as a people see nothing in this world to hope for, or work for, except the return of the good old mining days. Nevada has built enough palaces in distant cities. What she needs now is to build humble houses by the thousand in her beautiful valleys.

Nevada's Supreme Advantage. The man who knows Nevada only from the car window, would meet this observation by saying that the State has no beautiful valleys, and no opportunity to develop prosperous industries beside mining. People who talk this way are simply ignorant. Nevada has a wealth of water and land, a considerable home market for her products and a good prospect of an increased market in the future. In the Carson Valley, as in several other localities, may be found farmers whose prosperity is as great, possibly greater, than that of the best agricultural counties in New York, Pennsylvania, Illinois or Kansas. The soil and climate are exceedingly favorable to diversified agriculture, though the higher val-



THE WEALTH OF A PECOS VALLEY GARDEN.

leys cannot be depended upon for a regular fruit crop. Fruit is raised, however, and it is of a very superior quality. Nevada has one marked advantage over any other State, and this is in the matter of cheap land. It is probable that no other State can offer land as cheap as it might be offered by Nevada, if there were sufficient interest to develop irrigation works in the most favorable localities. This is an advantage of the highest importance, for there are vast numbers of people who desire land but cannot obtain it upon the terms on which it is generally offered. There is a sturdy minority in Nevada who appreciate these facts, and it happens very fortunately that one of them sits in the Governor's chair. He has some strong sympathizers among the wealthy men of the State, and some good backers in the editorial fraternity. It would not be at all strange if there were important developments in regard to the settlement of colonies in Nevada during the four year's term of office of Governor Jones.

The World Wants Proof. Nevada accepted the Carey grant of one million acres, but made no provision for utilizing it. The school lands are obtainable upon easy terms. Indeed, the terms are too easy, and have resulted in the acquisition of large and valuable tracts by speculators, who are waiting to realize profits from men of enterprise who shall invest their money, or from settlers who shall invest their labor. But there are still vast bodies of land which can be obtained in Nevada on very easy terms by those who desire to reclaim and colonize them. But in most places costly storage works will be required. It is a pity that they cannot be built under some form of public enterprise. Probably the easiest and quickest way to solve Nevada's problem, and turn the tide toward population and prosperity, would be to establish one colony which would conspicuously illustrate the possibilities of her soil and climate. There are numerous places where this could be done by cheaply acquiring land which is subject to old water rights, and is thus supplied from the natural flow of the streams. When the American people discover that Nevada is a fit place for the making of homes, and that homes can be obtained there more easily than anywhere else, the tide will set in that direction. But very naturally the public will wait for Nevada to demonstrate her own faith in these possibilities.

California's Mistaken Policy. Californians are feeling fairly cheerful this season. The freezing of the Florida orange crop created a good demand for the California product, and the destruction of deciduous fruits and grapes throughout the northern fruit belt, from Illinois to New York, promises to confer additional benefits. But the fact that such unfortunate incidents as these are necessary to make good prices should set the Californians to thinking. Is it not time for them to stop increasing the production of things which they now export largely, and begin to increase the production of things which they largely import? The scheme of the diversified farm, which aims first at the production of what each family consumes, and then of a surplus adjusted to the demands of a local market, and figures last of all upon producing what must be sent to distant markets, bearing heavy transportation charges, is just as well suited to California conditions as to those of Utah or Idaho. And there can be no question that farms organized upon this theory will be far more prosperous in the long run than those which are planted to a single class of crops. Those who went exclusively into the raisin crop have already learned this lesson. In time the lesson will be taught to those who confine themselves to other branches of horticulture. The fact is, that competitors of the California fruit industry are growing up in half a dozen States which are nearer the great markets and offer cheaper land and better railroad facilities. There is probably no place in the world where a fairly industrious man can get so good a living for so little work as in California, but it is not to be obtained in the long run by dependence on the single crop.

The Sacramento Valley. During the past ten years the agricultural population of California has increased chiefly in the southern counties and the San Joaquin Valley. We are inclined to predict that the next decade will see the largest increase in the temperate belt on the eastern slope of the Sierra Nevadas and in the Sacramento Valley. Northern California has been much neglected and has developed on the worst possible lines. In the first place, the people have sneered at irrigation and have raised in consequence about one-quarter as much as they could have raised with the right amount of moisture at the right time. In the second place, they have gone in for large farms almost exclusively. A few have prospered, but most have grown steadily poorer. The agricultural population of the Sacramento Valley actually decreased between 1880 and 1890. It is said on good authority that the public and private debt of the valley exceeds the actual value of all the real and personal property. And yet the capabilities of the country are simply incalculable, and every twenty acres susceptible of irrigation ought to win a living, and, in a lifetime, a reasonable competence, for a family. Furthermore, the climatic conditions are favorable to the development of the most charming forms of social life. What the Sacramento Valley needs is irrigation, a reformed agricultural system, and new blood. With these three elements a wonderful civilization could be realized, but the result

could not be obtained with any of these factors missing.

The Oregon Outlook. The friends of irrigation in Oregon are much depressed at the failure of their Legislature to accept the Carey grant and provide for a State Engineer. But there is no good reason for discouragement. It is only in very recent years that Oregon would seriously entertain the proposition that irrigation was necessary. A large majority of the people live where the climate is very humid, and are more inclined to vote for appropriations that would help to shut the rain off, than for those designed to assist in furnishing artificial moisture. And yet during the past winter some of the strongest influences west of the Cascades were arrayed on the side of the irrigation measures pending in the Legislature. It seems highly probable that if there had been no senatorial contest on hand, legislation would have been secured and the irrigation era fully inaugurated. There is a vast amount of land in eastern Oregon that can be reclaimed, and some of it could be opened up for colonization quite cheaply. The greatest need of immediate action, however, is in districts already settled by people who cannot get a living under present conditions. The country around Pendleton is such a district, and it is sincerely to be hoped that the earliest irrigation developments in Oregon will occur in that locality.

Idaho People Cheerful. In Idaho there is a growing enthusiasm in regard to colonization. The new Plymouth Colony is destined to be one of the chief glories of this State, and the people are beginning to see it in that light. Perhaps no other western State is gaining ground more rapidly than Idaho, or promises to achieve more in the next ten years. Idaho is one of the few States which does not have to worry about water supply, or discuss storage possibilities. Several plans are on foot to make use of the Carey law.

J. J. Hill in the Northwest. The reported ascendency of James J. Hill in the Northern Pacific control may mean a great deal more to Montana and Washington. With the Great Northern and Northern Pacific both in his hands, and with a vast domain of arid lands on the line of these routes, it is more than likely that Mr. Hill's phenomenal energy and extraordinary ability will be directed to the work of reclaiming and settling this territory. He has intimated as much already in a published interview.



IRRIGATION IN THE HAWAIIAN ISLANDS.

BY GEO. MANSON.

HOW many people are aware that fully one-half of the sugar crop of the Hawaiian Islands, or say about 60,000 tons per annum, is raised by means of irrigation? And yet it is a fact that were it not for pipe lines, artesian wells, vast irrigation ditches and various other appliances for the transmission of water, including pumping machines of the most extensive and expensive kinds, Hawaii would not make the showing in the world's product it does now. And while it is true that the sugar crop in these islands is constantly on the increase, it is equally true that that increase is due solely to improved appliances, both irrigation and milling—all of the available lands which derive their water supply from natural sources alone, having already been placed under cultivation.

While the numerous rice and tare patches which are scattered throughout these islands, and which require to be almost continually under water, are supplied from natural sources, each patch of an acre or less being situated a few inches lower than the one above, the water from some natural stream or spring being allowed to filter slowly downwards from one to the other, it is a very different matter with the cultivation of sugar cane, which must be irrigated to a certain degree, according to the age of the plant, and no more. The water must not be allowed to stand about the roots for any considerable time. Hence in large sugar plantations a large and continuous supply of water is the first and most important desideratum, and to obtain this and be certain of it at all seasons of the year is the great problem to be solved in order to secure good crops of sugar, and every means is adopted looking to that end.

Principal among these is the storage of water in reservoirs in the mountains, whence it is piped to the plantations, sometimes for many miles, and distributed as required. This is the plan adopted at Spreckelsville, the great sugar plantation on the island of Maui, which is the largest on the islands, if not in the world. It is owned by the Hawaiian Commercial and Sugar Company, but its stock is entirely controlled by the Spreckels family. At Spreckelsville the water used is conveyed through an immense ditch twenty miles long, the ravines being crossed by iron pipes supported by trestle work. Even this supply was not enough, and Mr. Spreckels has recently had completed a three-mile line of iron pipe 24 inches in diameter, which taps another source of water, and opens up 500 acres of new land for irrigation. It is claimed by Mr. Spreckels that it cost him $750,000 to put the necessary water on his cane lands.

This system of irrigation is also adopted on many of the plantations on the island of Hawaii, but the rainfall being so much greater on that island, less storage water is required, the cane lands being irrigated by means of ditches or flumes connected directly with some large spring or creek. The plantations in the vicinity of Hilo are examples of this mode of irrigation, the cheapest of all.

Another means of irrigation, which is practiced most largely on the island of Oahu where the rainfall is less than on any other island in the group, is the transferring of water from springs or creeks situated on low lands to higher ones, by means of pumping machinery of the most extensive kinds. Where this is done it is usually in connection with artesian wells, of which there are many in this island.

The artesian belt of the island of Oahu, according to an extract from the exhaustive report of Messrs. Allardt and Schuyler, the well known civil engineers, consists of a marginal rim around the island from sea level back to an elevation of 21 to 24 feet above. In and around the city of Honolulu water will flow at the maximum height of 42 feet, and here the largest and strongest wells are found. In the Ewa and Pearl City districts, which are situated some ten miles west of Honolulu, the limit of rise is 32 feet, and in the other districts on the north side of the island it ranges from 21 to 26 feet. The average depth of the many wells so far bored is about 500 feet, the greatest depth being at Honolulu. The combined flow of a group of four of these wells has been ascertained by careful measurement to be 10.68 cubic feet per second, equal to half the water supply of San Francisco. Two of the smallest of these, aggregating 4.1 cubic feet per second, are now made to irrigate 100 acres of rice. On no other island of the group has artesian water been found, and it would seem that nature has thus compensated Oahu for its deficient rainfall. Even the geological formation is so different from that of any other region of the world where artesian water is obtained by boring, that no scientific man would have risked his reputation in predicting the possibility of securing flowing wells by boring in the volcanic and coral formations of this country before success had demonstrated the fact. To Mr. James Campbell is due the credit of having the boldness to try the experiment which resulted in the first flowing well in these islands. This well was bored ten years ago on the lower slopes of Honolului ranch and a good flow obtained at 273 feet. This well flows as well to-day as when it was first bored.

All of the lands in the southwestern portion of this island, with the exception of a few scattered homesteads, are granted to the Oahu Railway and Land Company, and on a 60-year lease. This company was formed for the purpose of circling the island both ways from Honovliuli, but as yet only twelve miles have been completed. Eighteen more have been recently graded, the rails for which are now on the way.

Some four years ago the great Ewa Plantation Company was formed, its stock being subscribed mostly at home. This company leased 5,000 acres from the railroad for a term of 50 years. The soil was analyzed and found to contain every requisite for sugar cane, and the water question was solved at once by boring artesian wells. There are now twenty of these on the plantation, each ten inches in diameter, divided into three stations distributed as follows:

The main pumping station, has twelve wells within a space of 150x100 feet. The water is taken direct from the wells by two powerful Blake pumps, the first of which throws 7,000,000 gallons of water to an elevation of 108 feet daily, while the second 8,000,000 gallons to a height of 160 feet every 24 hours. About one-third of a mile from the main station are six wells with a pumping plant of the capacity of 20,000,000 gallons per day. At about the same distance in another direc-

tion is still another station of three wells, from which 3,000,000 gallons are pumped daily. This gives an aggregate of 28,000,000 gallons of water available daily, year in and year out, for irrigation, with one well not accounted for. The company claims that if the pumps were run to their full capacity the output could be increased to 40,000,000 gallons daily. During the four years these wells have been running, the flow has never altered; winter and summer, day and night make no change in them.

With this immense volume of water the Ewa Plantation Company is irrigating 3,000 acres of sugar cane, 773 of which was cut and milled last season. Whether from the natural fertility of the soil, combined with abundance of water, one of the most complete mills in the world and good management, or from some other and unknown cause, certain it is that the Ewa plantation shows results not obtained in any other sugar country in the world. What will your Louisiana planters say to a net yield of 10.06 tons per acre from a 40-acre field? This amount, the largest ever known, was actually produced at Ewa last season.

The following memorandum kindly furnished by W. J. Lowrie, manager of the Ewa plantation, gives the unprecedented yield of sugar from plant cane for their crop of 1894, which was found to average, as will be seen by the following figures, nearly 8⅓ tons per acre.

272	acre field	average	7	tons	1,904
131	" "	"	7½	"	982.50
72	" "	"	7¾	"	558
139	" "	"	8¾	"	1,156.25
123	" "	"	9¾	"	1,199.25
46	" "	"	10.06	"	487.60
773					6,287.60 tons

Notwithstanding the remarkable yield given above, which is the largest average ever obtained on these islands, the writer is informed by Manager Lowrie that the yield from the crop of 1894 would have been fully 1,000 tons more if the capacity of the mill had been such as to do the work required in five instead of eight months, a loss of an amount equal to the first cost of a large mill. The great importance of erecting a mill with a capacity sufficient to take off the entire crop in five or not more than six months is thus dearly shown. It will not occur again at the Ewa mill, which has been improved and its capacity largely increased for this year's run.

A ten-inch artesian well belonging to the railroad and sunk near the depot, supplies Pearl City with water. The water is pumped into a reservoir on high ground, from whence pipe lines supply the depot and private families for a distance of two miles, besides furnishing water enough to irrigate several fruit ranches containing over half a million pineapple plants, besides hundreds of thousands of young orange and lime trees. This well furnishes the purest and sweetest water found on the island.

All of the available sugar land in this vicinity is owned by the Oahu Railway and Land Company under a sixty-year lease, and so highly pleased are the managements of that corporation with the flattering results obtained at the Ewa plantation that they have determined to go into the sugar business themselves. For this purpose an outside corporation has been formed, under the name of Oahu Sugar Company, with a capital of $3,000,000, of which $1,600,000 is to be bonded and the balance issued in shares of $100.

The railroad company leases to the Oahu Sugar Company 10,000 acres of choice sugar land, 3,000 acres for a term of forty-five years and 7,000 for a term of sixty years. The land is nearly all smooth and can be divided into fields as large as 1,000 acres if thought desirable. It is free from rock, brush, trees or other obstructions and plowing could be commenced on it at any time. It is covered with a rich growth of Bermuda grass and is now used as part of the railroad company's stock ranch. All plowing at the Ewa ranch and on the new proposed plantation is and will be done by steam. The writer has been over the grounds included in the lands of the Oahu Sugar Company and can vouch for the statements concerning it, made in the article. It is but a short distance from the railroad, from which a spur will be put into the mill as soon as grinding commences. The plantation will be simply a network of railroad lines running to the mill, as the cane will be transported from the various fields to the mill by steam, no wagons being used. From the mill the sugar will be taken to the ship by the railway company, which owns an immense wharf, coal sheds, etc., at Honolulu. The largest ship that ever floated can dock alongside this wharf, and for that matter can coal up in forty-eight hours if necessary, as the company carries a big supply of that necessary article at all times. It supplies the Ewa mill and pumping plants with 3,000 tons annually, besides many steamers and its own supply.

Almost in the center of the proposed new plantation are the Waipahu springs, with an average flow in dry seasons of over forty cubic feet per second. It is proposed to carry this water on the higher lands of the plantation, which are situated at an altitude ranging from 200 to 620 feet above, the average being 410 feet.

With a view of obtaining as much information as possible concerning this new sugar corporation, which will be the second largest in the islands, the writer called on B. F. Dillingham, the general manager of the Oahu Railway and Land Company.

In response to inquiries, Mr. Dillingham said that the prospects of the new company were very flattering and that there was no doubt of its ultimate success. He had found also, that his estimates of expenses as published in the original prospectus were much too high. For instance, said Mr. Dillingham, on the pumping alone, I was nearly 100 per cent. too high, and I have just received a letter from the Henry R. Worthington Pump Company in which they offer to raise 20,000,000 gallons of water per day of twenty-four hours, to an elevation of 620 feet, at a cost of $200 per day. Now that is just one half of what I figured on, and our average elevation is only 410 feet.

"Can you give me any more information about this new company, Mr. Dillingham, which will be of interest to earnest readers?"

"Why, yes; I can tell you something that has not even been made public. When we first organized the company it was proposed to issue $2,000,000 of stock. Now we are going to bond the property for $1,600,000 and issue only $1,400,000 stock.

"Since the issue of the prospectus of the Oahu Sugar Company referred to, I have received a quotation from the Henry Worthington Pumping Company for an entire pumping plant, consisting of four high duty triple expansion pumping engines, complete and ready for operation at a price considerably below the

estimate made in my prospectus, the capacity of the four pumps to amount to 20,000,000 gallons per day of twenty-four hours, delivered at an average height of 410 feet and at a maximum height of 620 feet above sea level. The Worthington people say this can be done, with coal delivered at furnace at $7.50 per ton, at a cost of $200 per day for coal, or say $72,000 for pumping every day in the year. If we allow nearly 50 per cent. advance upon these figures for other expenses, including possible repairs, and call the whole expense $100,000, it will then be $200,000 less than the estimated cost given in my prospectus."

POSSIBILITIES OF SOUTH DAKOTA.

BY G. C. CRIST.

LAST year saw a great awakening of the Western mind to the transcendent importance of irrigation. This was caused in a great measure by the drought which afflicted the entire West, and whose ravages the East did not entirely escape. Along with the other Western States South Dakota has been brought to appreciate more fully the character of irrigation and the certain and lasting benefits that follow its adoption.

Eastern South Dakota being entirely within the humid belt does not require irrigation. The average rainfall is entirely adequate. But in any country there will occur occasional years of drought, when the damage to crops amount to a sum which would more than pay for the cost of building ditches over the entire area of irrigable land. Many men of Eastern South Dakota realize this, and are going in for the building of irrigation ditches where the topography of the country, the supply of water and other elements to be taken into consideration, are especially favorable.

The central portion of the State is plentifully watered by the Missouri river and its tributary streams. Being at about the western limit of the humid belt the desire for irrigation is more keenly felt. The next few years will see the rapid growth of irrigation in that section. There is no finer land in the world than it possesses, and though very productive now, with irrigation it will be made trebly productive.

The Black Hills, often called the richest mineral region on earth, occupy the western portion of the State. The energies of its people have been almost exclusively devoted to the development of its wonderful mineral resources, while agriculture has received but little attention. During the last few years the Hills country has had a great advance in population and prosperity. Railroads have been built connecting it with Omaha, Chicago and the East. The result has been an added impetus of growth. The Black Hills now offer one of the best markets in the country for the sale of agricultural products. The mining towns consume a great deal, while their productions are only gold and other minerals.

Irrigation is not an entire necessity in this region. A great deal of farming is done without its beneficent aid. Nevertheless several energetic men, aware of the great profit in agriculture through irrigation, commenced the construction of a canal at the southern slope of the Black Hills. When completed the canal would irrigate 10,000 acres of fertile land. The starting point of the canal is the confluence of Beaver Creek with the Cheyenne river, 14 miles northwest of Edgemont, a bright little city at the junction point of the two lines of the C., B. & Q. system which penetrate this region. Every foot of the 14 miles of level land which lies between the large storage reservoir at the head of the canal and its termination at Edgemont can be irrigated. There are also two other reservoirs of considerable extent; one four miles from Edgemont, the other on the high bluffs back of the town.

The Edgemont canal differs from most enterprises of the kind in that it is intended to do double duty. In addition to watering all the land along its course, the canal carries a volume of water sufficient to develop about 1,000 horse power—to be utilized by manufacturing establishments, and a fall of 72 feet makes this possible.

The canal was finished last autumn. Most of the land has already been plowed up in preparation for next season's planting. The settlers literally fell over one another in their eagerness to file on this land when it became known that the canal would be built. The soil of the Cheyenne valley on analysis was found to be very similar to that of the district about Greeley, Colo., which leads the world in the production of potatoes. Potatoes, alfalfa, sugar beets, barley, rye, oats and flax will form the principal crops, together with such vegetables as will find a demand in the "Hills."

Altogether the certainty of a prosperous future for the Edgemont irrigated land offer tempting inducements to the extension of irrigation in this section. Not alone will it benefit the farmers themselves, but the stimulating effects will be felt by the entire region. As an example, Edgemont has already doubled in size as a result of the construction of the canal. The following out of the policy of the extension of irrigation, each individual district for itself, is what will make the trans-Missouri region in course of time the most important part of the nation, as it is already the greatest in area and natural resources. Irrigation is—as Gen. Hancock said of the tariff—largely a "local issue." This, however, is not inconsistent with the hearty support of such measure as may be taken by the national or State government for the development of irrigation and the reclamation of the arid land of Western America. The people of South Dakota reverence "Water—the God of the Harvest," and may always be depended upon to heartily support any plan for the extension of the blessings of irrigation.

Official Call for the Fourth National Irrigation Congress.

BY the authority of the National Executive Committee, the Fourth National Irrigation Congress is hereby called to meet in the city of Albuquerque, New Mexico, for the four days beginning September 16th, 1895.

The present year is proving to be the most remarkable in the history of American irrigation. It has seen a wonderful awakening of popular interest in the cause throughout the East, resulting in the organization of most potential forces for the purpose of co-operating with the Western people; the enactment of well-considered irrigation laws in eight States, and the creation of administrative systems in five of them; the recognition of the pressing nature of the problem by the Departments of Interior and of Agriculture, under whose direction a National Board of Irrigation has been formed from officials in various departments of the government.

These splendid evidences of the triumphant progress of the irrigation cause demand a large, representative and effective session of the Irrigation Congress in 1895. A further season for such a gathering is the fact that the Presidential campaign of 1896 will be inaugurated previous to the assembling of another session of this body, and that it is thus necessary to formulate at Albuquerque the demands which the friends of irrigation will desire to make upon the great political parties of the nation.

In view of the nature of the opportunity, a programme of extraordinary variety, interest and importance will be arranged, and it is anticipated that this session of the Congress will be more widely useful and influential than the previous conventions at Salt Lake in 1891, at Los Angeles in 1893, and at Denver in 1894. The friends of irrigation throughout the United States—for to-day the movement is national in its scope and interest—should unite in an effort to obtain a worthy result at Albuquerque.

BASIS OF REPRESENTATION.

In accordance with a resolution of the Third National Irrigation Congress at Denver, Colorado, September 8th, 1894, the Fourth National Irrigation Congress will be composed as follows:

1. All members of the National Executive Committee.
2. All members of State and Territorial Irrigation Commissions.
3. Five delegates at large, to be appointed by their respective Governors, for each of the following States and Territories: Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington and Wyoming.
4. Three delegates at large, for each State and Territory not heretofore enumerated to be appointed by the Governors of said States or Territories, or, in the case of the District of Columbia by the President.
5. One delegate each from regularly organized irrigation, agricultural and horticultural societies, and societies of Engineers, Irrigation Companies, Agricultural Colleges and Commercial bodies.
6. Duly accredited representatives of any foreign nation or colony, each member of the United States Senate and House of Representatives, and each Governor of a State or Territory will be admitted as honorary members.

The use of proxies and the manner of casting the vote of delegations, will be regulated in accordance with a resolution adopted at Denver, and printed on page 89 of the Official Report of that meeting. By order of

THE NATIONAL EXECUTIVE COMMITTEE,

FRED L. ALLES, Secretary. WILLIAM E. SMYTHE, Chairman.

IRRIGATION BY PUMPING IN KANSAS.

BY C. C. HUTCHINSON.

THE enormous influence exerted by the IRRIGATION AGE, can only be appreciated by those who travel across the continent and take note of this work. Here in Kansas it brought to the front a dozen men who were called cranks by their neighbors, but who practiced and advocated irrigation in season and out of season, until now this faithful handful of men has become a thousand, and the State recognizes the importance of the subject by legislation and by appropriation for experimental work.

The State irrigation convention held in 1894 at Hutchinson, on the banks of the Arkansas river, was the largest gathering of the kind ever held in the United States, and awakened an interest in the entire State, which has been increasing ever since. A peculiarity of irrigation here is that it is based almost entirely upon pumping.

To those who have a ditch full of water flowing along the highest portion of their ranch or farm, this pumping irrigation seems but a poor substitute for gravity flow. But the conditions in Western Kansas are extremely favorable for pumping, owing to the great abundance of sheet water found under all the valleys, and to a greater or less extent under the uplands. Upon the other hand, there is not much water which can be obtained directly from flowing streams, although a considerable amount may be impounded in small reservoirs. Sheet water in unlimited quantities underlies the broad Arkansas River valley at a depth of four to ten or twelve feet below the surface, and at a depth of ten to twenty feet in many other smaller valleys of Western Kansas. On the uplands, wherever tested (with few exceptions possibly) water is found 40 to 200 feet below the surface. This water is always pure and cold.

Thousands of pumps are drawing water from these various depths to the surface of these fertile valleys and plains. Wind mills are running, and others being erected, of all patterns, from the farm built "jumbo" to the highest priced steel wind mills, standing on tall steel towers; while gasoline engines are numerous, and an occasional steam plant of 10 to 80 horse power. People who are familiar with irrigation are convinced that in this pumping system is the solution of vital questions here, and those who have pumped water a year or two are enthusiastic as to the results.

Some people and some newspapers are antagonizing the "irrigation fever" by advocating deep plowing, and especially sub-soiling. All this commotion, resulting largely from the efforts of the AGE, furnishes additional evidence that "the world do move," and leads to the following brief suggestions:

1st. Let him whose soil or sub-soil is hard use a sub-soil plow, which merely lifts and loosens, but does not bring new soil to the surface. All such land will be benefitted, and it is a desirable preparation of such soil for pumping irrigation.

2d. The wind power of this country has hitherto been recommended only for its healthfulness and for its cooling summer breezes, but it affords a cheap power for pumping, which is also being utilized for grinding, cutting fodder and filling silos, churning, washing, sewing, running light machinery, and may sometime provide stored electricity.

3d. It is not expected to irrigate large tracts by pumping. Single wind mills of various sizes are now irrigating one acre, five acres, and in some instances ten acres, depending upon size of mill, height of lift, character of soil and manner of applying water.

Outside the valleys, and excepting a few counties with extraordinary underflow of water, it is not expected that more than five or ten acres will thus be irrigated out of every 160 acres.

4th. But this insures a living for a working family on every quarter section where water is obtained, and whoever has wit enough to successfully irrigate will soon have sense enough to adapt his cultivation and crops to the soil and climate, and want will be unknown.

5th. It is becoming known that reservoirs are needful to furnish sufficient head to carry an irrigating stream where it is needed, and to warm water in the sun before applying to growing crops. Few of these reservoirs are built with sufficient care to make them tight. The top soil should be removed to a depth of six or eight inches, entirely outside the foundations of the banks. Then plow around where the banks are to stand, and harrow the same, pump water onto it and puddle by plows or scrapers; or better yet, by tramping of stock. Now scrape inside of this ring and commence the banks, wetting the same as you build up. When the banks are high enough plow and harrow the bottom of the reservoir, and after wetting it a foot or more in depth thoroughly, puddle it by tramping of stock. If the soil is sandy haul clay and spread it in the trough through which water flows from the pump, stirring the clay with a rake that it may be worked into the sandy soil on the bottom. If the reservoir leaks after completion keep a supply of clay, or clayey soil, in a long trough, carrying the pump water into different portions of the reservoir, and these fine particles of clay will be carried by the leaks and percolations in the bottom or sides of the reservoir and finally make it as tight as a jug. For fish breeding, the water standing below the surface of natural soil is desirable, and breeding black bass, perch, croppie, etc., is profitable and agreeable.

Of course, if you have a naturally good bottom, do not go through it into sand. Bore down with an auger and find out.

6th. People here do not sufficiently appreciate that water from a pump should be applied to the soil whenever the wind blows enough to pump; be it fall, winter or spring. By this means and constant surface tillage, but little, or very much less, summer irrigation is needed. Wind mills erected this year will thus show greater results next year than now.

Hutchinson, Kansas, April 20, 1895.



DEMONSTRATION FARMS.

BY J. W. GREGORY.

The suggestion of THE AGE that there should be a series of irrigation farms at various points in the arid and semi-arid regions, where those interested in irrigation might be shown the practical workings and effects of this great feature of the future agricultural system of the United States, is both timely and eminently practical, as a general proposition; but permit me to say that, so far as Garden City is concerned, which was one of the locations you suggested for such a farm, we already have a number of them ready for inspection. Within a radius of three miles from Garden City depot may be seen at least two score irrigated tracts, ranging in area from a quarter section down to a couple of acres, and under cultivation and irrigation for two to fifteen years. Upon these may be found growing more than fifty different primary sorts of fruits, vegetables, grains and forage plants, and of some of these many different varieties. Of apples, for example, there may be found, doubtless, nearly or quite fifty varieties. I know of twenty-eight in one orchard, nearly twenty already in bearing. Of plums, cherries and all other fruits, the so that results are what the average man may hope to secure by average means. Along with the man who has succeeded, and can tell how he did it, may be found also the man who failed on a similar crop at the same time, and is finding out why he failed. Along with the great variety of crops may be found, beside the usual variety of common stock, fine specimens of blooded horses, cattle, sheep, swine and poultry—yes, and dogs. Here are bees, from the single stand up to apiaries numbering up into hundreds of colonies, turning out alfalfa honey as limpid as spring water in snowy combs, as spotless as Calphurnia's reputation was required to be; and in the rapidly multiplying ponds are swarming multitudes of fish (if fish may properly be said to "swarm") of many and increasing varieties.

In fact, here is already in operation the most prac-

various grains and vegetables, there may be found the range of varieties to be looked for in a settlement of the most courageous, enterprising and determined people on earth. Had a whole section been planted with all these different varieties of crops ten years ago, and carefully tended as an experimental farm, it could scracely be of the practical value to the average man that these various tracts now are; for these are scattered about upon different qualities of soil and from river bottom to upland, and are handled by men of different ages, temperament, methods and education,



A TREE-BORDERED CANAL IN THE PECOS VALLEY, NEW MEXICO.

tical sort of typical demonstration of what may be accomplished by irrigation, and it has already sown good seed far and wide, and most valuable results to the whole Great Plains region are "in sight." What has been done here has made enthusiastic irrigationists of our Governor Morrill, our Ex-senator Ingalls and a great many more of our leading editors and public men, beside, what is more important, serving as an object lesson to hundreds of farmers from the surrounding country—some from long distances—who have come, and seen, and studied for themselves and gone home to spread the gospel of irrigation—the redemption of the desert.

And everybody interested is welcome to come and see what our people are working out for themselves. Judging from nearly fifteen years' observation, I feel safe in saying you will be well treated by our people.

IRRIGATION IN BARSTOW, TEXAS.

BY J. W. WOODROUGH.

THE IRRIGATION AGE has already touched upon the sources, size and infallibility of the Pecos as an irrigating medium. Unlike the Rio Grande and other Texas rivers, it flows a constant and never failing volume of water almost as rich in silt and fertilizing matter as the Nile itself.

One of the largest irrigation plants in Texas, The Pioneer Canal Co., of Barstow, have tapped the river by means of a simple but safe and practicable dam, diverting the river from its bed into their large main canal, which conducts it away in winding courses for twenty miles, through a rich and fertile valley, crossing the river by means of an aqueduct, or flume, 400 feet in length, and passing through the town at Barstow. Main canals and laterals, as constructed and in process of construction, render about 100,000 acres of land available for irrigation by the waters of the Pecos river. Many laterals and sublaterals branch off at intervals of one to two miles, and on either side lie fields and orchards that promise, in a short time, to vie with the most beautiful in the United States. Many of the farmers under the canal have devoted themselves to raising alfalfa, with eminent success.

The loose, sandy loam of the valley produces wonderful crops of hay, from five to seven cuttings, and as much as two tons per acre per cutting. The orchards that have been set out prove the unusual suitability of the climate, soil and water for fruits of all kinds. All kinds of grain and root crops have been raised, and farmers here contend that nothing grows anywhere in such abundance that the Pecos valley cannot beat it. The town of Barstow, where the Texas & Pacific R. R. crosses the Pecos river is the county seat of Ward county, and promises fair to become a beautiful city at no distant day. It boasts the finest school house and court of any town in West Texas. Both of the above mentioned buildings are built from red sandstone quarried in the hills a few miles from the town. The dwellings are of the most substantial and artistic character, and betoken the good taste and elegance of the citizens. The owners of the town site stipulate that no frame building shall remain unpainted, and that no liquor shall be sold in the town limits.

These provisions, and the generosity of the town company in supplying trees and shrubbery to the citizens, are a guarantee that the tone and beauty of home shall not be impaired by surroundings. Both townspeople and farmers have enjoyed uninterrupted prosperity this year, and have bothered very little about politics and strikes, and the crops have prospered without exception. New lands have been taken up, and alfalfa, fruit, trees, corn, cotton, gardens and happy homes have taken the place of the wild grass and mesquite. Thousands of arid acres have been reclaimed and made to blossom like the rose.

Much remains to be done, but with the experience of the pioneers as a guide, new comers can make their calculations as to cost and returns accurately and with confidence that there are no hidden drawbacks. We do not need to rely on theories and inferences; the great capabilities of the country are demonstrated an accomplished fact. We acknowledge gratefully the assistance the columns of THE IRRIGATION AGE have rendered us. THE AGE is foremost in the great fight against aridity, sterility and homelessness, and we are proud to feel ourselves combatants in the ever increasing ranks.

CENTRAL KANSAS ENTERPRISE.

BY A. C. ROMIG.

IRRIGATION in Central Kansas is yet in the experimental stage, and the advocates of intense farming and artificial wetting encounter many skeptics, who take a pessimistic view of the whole business. Fortunately, we have a liberal percentage of live, progressive farmers, who understand the situation and possibilities, and will this season demonstrate the profits of irrigation.

Hon. C. B. Hoffman, of Enterprise, has 120 acres under ditch, leased in small parcels to practical irrigators from Colorado, at an annual rental of ten dollars per acre. For motive power he is utilizing the Enterprise mill dam on Smoky Hill river, operating on a Mange centrifugal pump of 150,000 gallons per hour capacity.

M. M. Whitlaw, of Abilene, has a No. 3 link belt elevator of 700 gallons per minute capacity, and is wetting twenty-five acres in the Smoky Hill bottom, pumping direct from the river and distributing through furrows and laterals. There are other link belt and wind mill pump and reservoir plants that will demonstrate the possibilities of upland irrigation.

The ditch or canal system in vogue in the mountain districts is with us impracticable, because of high banks, low gradients and long conduits. As expressed by Prof. Carpenter, of Colorado Experimental Station, Kansas must develop her own system, which will be the lifting process from streams and wells, and by individual effort.

This system may have its defects and cost a little more, but it leaves the farmer freed from the domination of an overshadowing corporation. He maintains his individuality, is independent, and dictates his own policy.

It is conceded that our crop failures are largely due to lack of moisture in the sub-soil. This defect, we, in Kansas, propose to remedy wherever practicable, by arresting the surplus water in its mad haste to reach the Gulf of Mexico, and spilling it out over the fields in the fall, winter and early spring, thoroughly saturating the sub-soil and making a deposit of moisture that will honor the drafts sure to be made upon it in the hot months of summer.

When every farmer shall have his plant of five to twenty acres or more, as he will in the near future, giving him assured living for his family, Kansas will evolve the most thrifty and independent rural population and develop the best country on earth.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

Short, practical articles, notes of experience and observation, are invited from the readers of THE IRRIGATION AGE who are interested in the promotion of the idea of the small diversified farm providing to the fullest economical extent all of the various articles of food, clothing, etc., required by the family.

DEEP IRRIGATION.

BY JOEL SHOEMAKER.

WATER is valuable to crops just in proportion to the manner of application. Some soils admit of flooding, others do better under seepage, while nearly every character of land produces the best crops by furrow irrigation. The principal object in producing moisture is to get it in the place where the growing crops demand nourishment. Very few crops require surface irrigation and hence flooding is not the most advisable method of applying water, except to such plants as require dew and moisture on the top of the ground. The best results are usually attained by irrigating in deep furrows.

The furrows should be so constructed that water will not flow too freely and wash away the soil. A gradual slope is the better plan for making good ditches and will always produce better crop results. The water should never touch such crops as beans, peas and corn. Shallow surface irrigation will always result in decreasing the production of all crops grown above ground. The root crops, especially sweet potatoes, peanuts and Irish potatoes, will be better in quality and more productive in quantity if water is kept away from the roots and tops while growing. The rust and scab frequently noticed on root crops can be avoided by deep irrigation and keeping the water away from the growing bulbs.

Furrows should always be made and water run through them once before the crop is planted. This serves a double purpose of showing the high places in the land and evenly and properly distributing the moisture for germinating the seed. New land should be furrowed out and irrigated once after the first plowing and then plowed over and leveled before planting. Small shovel plows are good implements for making irrigating furrows. They throw the soil on either side and thus make embankments for preventing the water from spreading over the surface. If the plow does not run deep enough the beam should be weighted sufficiently for the purpose.

Growing crops demand moisture but do not require water. If too much water is placed on or near the surface it will cause the alkali in the soil to rise and crust around the vegetable plants. Deep irrigation has a tendency to draw off the alkaline substance. The moisture does not rise to the surface and consequently does no harm in baking or crusting. Deep furrows place the moisture where it properly belongs and allows the water to permeate the undisturbed space between the sub and surface soils. The water forms pathways that by circulatory veins keep the soil enlivened and prevents the loggy sourness noticeable in shallow irrigation.

Soil can be more quickly cultivated after a period of irrigation if the water has been applied through deep furrows. Weeds grow fast and cultivation is necessary. If soil is stirred when wet it will bake. If the plants are cultivated while wet they will become diseased with a rot which will destroy the yield. Surface irrigation by flooding or through shallow furrows brings upon the land an immense amount of noxious weed seeds. The common water grass and sand burrs, so destructive of crops, are nurtured by surface irrigation. Make deep ditches and keep the water from the surface you rid your lots to a certain extent of those pests.

Deep irrigation admits of better openings being made in the main or sub head ditches and allows a more even and systematic distribution. A small stream will trickle along a deep furrow and seep out on either side giving moisture to the roots of plants, when a greater stream would evaporate or be swallowed by the dry soil within a few rods if put in a shallow furrow. The water should not spread over the surface either by seepage or flooding. It makes the land unfit for passing over in changing the furrows. Where a man sinks into the soil on account of too much water the plant life for that season is destroyed.

NECESSITY OF SPRAYING.

SPRAYING fruits and vegetables has now become a necessity, in order to fight and ward off the attacks of insects and fungoid parasitic disease.

It has been estimated by those competent to judge that these pests annually destroy $500,000,000 worth of produce for the farmers and orchardists of the United States, and it is believed that much of the success of California fruit raisers can be accounted for by their intelligent use of spraying machines, etc.

The philosophy of spraying, is simply that of a practical method of distributing poisons on the surface of trees, shrubs, vines and plants; in such a manner that they will kill fungous pests and insects, which come in contact with them.

If the farmer and orchardist has a general knowledge of the habits, methods and development of injurious insects and fungoid growths, he will be better prepared to fight them. Nearly all these organisms are easier to destroy at some one time of their existence than any other, therefore a knowledge of their habits and life history is essential to success.

This, however, may be a study which the busy farmer and fruit grower has no time to undertake, even granting he had the inclination and previous necessary training.

Knowing these facts, THE IRRIGATION AGE last month gave a spraying table, embodying the experience of practical and scientific men, together with formulæs for making the various mixtures.

SPRAYING OUTFITS.

In large orchards, force pump outfits are a necessity, the main points to look after being that the metal parts of the pump which remain in the mixture are of brass or a material which it will not readily corrode; a device to keep the poison thoroughly mixed all the time, and last, but not least, a nozzle which will distribute the materials evenly, and can readily be cleansed should it happen to clog.

In many instances it has been found advisable to apply the poisons in a dry state, using a bellows or powder gun for the purpose. When this is done the poison is generally mixed, one pound of Paris green or London purple to three pounds of flour or gypsum (land plaster).

DIFFICULTY IN MAKING KEROSENE EMULSION.

The kerosene emulsion has been found, in actual practice, somewhat difficult to make.

Mechanical ingenuity has therefore been invoked, with the result that an apparatus has been designed for mechanically mixing the kerosene with the water at the moment of applying the insecticide as a spray. The Miss. Ex. Station describe such an attachment for Knapsack pumps in Bul. 30.

Professor Goff of the Wisconsin Station uses an attachment described as follows: For the water reservoir I used a five-gallon tin can, to which were attached three legs near the top, on which it can stand securely in an inverted position. Then a tin basin was attached to these legs at such a position that when the can is inverted the bottom of the basin hangs an inch and a half beneath the mouth of the can.

In the centre of the bottom of this basin is soldered a neck to which a screw cap is fitted.

Through this neck the tube of a funnel can be passed, so that it will enter the mouth of the can for filling.

Near the top of this can (or near the bottom when in its inverted position) is soldered a staple of heavy tin, to which is attached, by means of a hook, a one gallon can, with a basin suspended beneath its mouth, as in the larger can, the smaller can being used for kerosene. The kerosene can is hung at such a point that its mouth is on a level with that of the larger can. This arrangement maintains the two liquids at practically uniform levels. The suction pipes are placed in the basins, and the liquids are supplied from the cans as fast as they are drawn out.

With this arrangement there is no opportunity for the kerosene to accumulate by separation above the discharge-pipe. Should a very little accumulate in the air chamber, it is not likely to be forced back until after the pumping has ceased.

In experiments with this machine a Nixon nozzle, having a fine orifice diaphragm and medium gauze, was used, and a second diaphragm with a fine orifice was added at the union of the hose with the pump, which materially assists in forming the mixture.

A KNAPSACK SPRAYER.

Professor Weed, of the Mississippi Experiment Station, has issued a bulletin describing an attachment to the Knapsack sprayer for mechanically mixing kerosene and water. This machine has a gauge plate plainly marked to indicate the proportion of kerosene which will mix with the water, a very useful device, as will appear by the following:

In spraying for plant lice, the rule given is to use one part of kerosene to twenty parts of water. For lice on hogs, we would advise one part kerosene to two parts of water, etc.

It would seem that this is an excellent device, as kerosene will injure all insects that it reaches.

NO FEAR OF POISONED FRUIT.

The particles of poison used in spraying do not enter into the plant or fruit, but remain on the outside until driven off by the action of the wind, rain dew and snow.

While much has been said and written, both in Europe and America, against using fruit for food so sprayed, the better and more careful methods now employed have reduced the fear of poisoning from sprayed fruit to the minimum and secure finer fruit and larger crops to the grower, which by the law of supply and demand is also an advantage to consumers.

No talk on insecticides would be complete without reference to the work of importing parasites and predaceous insects. California has been the pioneer in this work, and where this method of fighting insect pests may end, the future alone can disclose.

Mention should also be made to the preventive measures of inspection and fumigution of imported trees, etc., from foreign countries, inaugurated by the state of California, an example which might profitably be followed by other states.

As to the fungicides, the Bordeaux Mixture is the principal combination of copper salts in use here, and its popularity would seem to indicate its value. It is important that enough lime be added to the mixture to neutralize the copper sulphates, which are liable to injure the foliage.

The American Plow.—"The plow used by the American farmer is a humbug and an enemy to fertility.

"We have improved our plows less than any other implement man uses. The plow used in Nebraska and other stoneless soils impacks every furrow it passes over and renders it as impervious to rainfall as possible. The draft of a plow is downward to such an extent that the full force of the team's strength is exhausted in pressing the bottom of the furrow into a polished trough for the conduction of rain down the side-hills. We must have some method of tillage which shall stir up the soil and subsoil to the depth of eighteen inches and more. If it were possible to loosen the soil and subsoil down for three feet all over the state of Nebraska, we could then, with an annual rainfall of twenty inches, make abundant and profitable crops.

"This is a matter of such vast importance that I have asked Chancellor Canfield of the University of Nebraska to bring it before the 1,600 students in that institution and ask them to try and think out a new implement of agriculture which shall supersede the plow. It is a subject upon which the inventive minds of educated farmers should be concentrated. A proper solution of the difficulty will facilitate subsoil tillage and at the same time save both the crops and the soil. In my judgment the coming implement should spade the land and turn it over, as a man who pushes the spade with his foot into the ground and drawing the spade out, turns the soil upside down by the twist of his wrist. Possibly a rotary spader could

be invented. Possibly an implement consisting of a large number of revolving knives could be made, so that in passing over the surface of the field it shall chop up the soil and subsoil for two feet in such a manner as to render the percolation of the rainfall down to the depth at which the ground has been stirred very easy and perfect."

The above words, spoken by J. Sterling Morton, have received quite marked attention throughout the country, and various have been the criticisms of the agricultural press thereon.

Most of us have heard the story of an old man sitting on a fence watching a plowman turn under the sod, and asking the farmer if it was not wonderful how men knew better than God what was the best soil for the surface of a field. Others may recollect the following newspaper cutting which went the rounds about Dec., 1891:

"Subsoil plowing with dynamite is one of the new methods in the south, and is said to be equal to the process of trenching used by market gardeners to loosen the earth to a depth of two or three feet, and allow the absorption of a good deal of water for sustaining vegetation during a drought. The inventor drills holes two or three feet deep and five feet apart, making 1,600 to the acre. In each he puts an explosive, and, after tamping, discharges it, the whole number being connected with a wire leading to a battery. In a recent experiment the explosive used was one-fourth of a small sized dynamite cartridge, with about an ounce of Judson powder. The surface of the ground appeared to be lifted two or three feet, a few small clods being thrown up to the height of a house. It was broken to the depth of 30 inches at the points of explosion, and sidewise for a part of the distance between the holes."

So far as the original or oriental plow is concerned, farmer visitors to the Columbian Exposition will remember how well the exhibits showed the evolution of the modern plow, and the many great improvements on the same down to the great gang plow of California, the mighty steam plow, and the novel and wondrous electric plow.

Nevertheless, the Hon. Secretary of Agriculture calls attention to one of the worst features of the machine, and one of vast importance in the arid region —the conservation of soil moisture.

It is a question, however, if the tool our Secretary is anxiously waiting and looking for is not already with us. I refer to the various spading and rotary disk harrows.

The writer recalls the substances of a conversation with Prof. W. A. Henry, of the Wisconsin Experiment Station, on the subject. The opinion was hazarded that we plow our land too much, and that in many instances the rotary disk harrows could be used to much better advantage than the plow.

Amount of Water Necessary.—Bulletin 39 of the Utah Agricultural College Experiment Station treats of farm and orchard irrigation. It reports results of a number of irrigation experiments, most of them covering a period of five years. The first experiment, which is discussed by A. A. Mills, is the amount of water to use for the different crops, and is summarized as follows:

1. On clay soil the maximum yield of both wheat and straw was obtained by saturating the soil, approximately, two feet deep at each irrigation, or covering the ground with 26.82 inches of water during the season.

2. On this soil there was a decrease of crop where either a more or less amount of water was used.

3. This maximum yield was secured by the use of 26.82 acre-inches, which is equivalent to a cubic foot per sec. for 27 hours, nearly.

4. Though the water that drained from the soil through excessive irrigation was richer in fertilizing material than when applied, the total amount of this material added is more than that extracted.

5. On clay soil containing more sand the yield of grain (wheat) increased as the water increased up to 40 inches, while the maximum yield of straw was produced with 16 inches of water.

6. On clay soil containing little sand timothy gave mixed results, though where the maximum amount of water (41.3 inches) was used, the yield was the greatest.

7. On clay soil containing more sand the first crop of clover increased steadily and rapidly from the use of 4.2 inches of water up to 12.9 inches. The application of 5.2 inches more of water decreased the crop nearly one-half.

Scientific Diet.—Bulletin No. 23 is the outcome of a study on human dietaries by Prof. Atwater, evidently with the intention of laying the foundation of an accurate basis of human nutrition.

It is generally agreed that man gives more thought and care to the scientific feeding of domestic animals than to his own nutrition. Successful dairymen, cattle raisers and feeders give their stock "a balanced ration," while we continue to afflict ourselves with foods too often dear in their first cost, unsuitableness for purpose intended, and in their consequences dyspepsia and all its horrors.

The following extract from the bulletin illustrates its animus, being the words of Sir Henry Thompson, a noted English physician, and authority on the subject: "I have come to the conclusion that more than half the disease which embitters the middle and latter part of life is due to avoidable errors in diet, * * * * * * and that more mischief in the form of actual disease, of impaired vigor, and of shortened life, accrues to civilized man * * * * * * in England and throughout central Europe from erroneous habits of eating than from the habitual use of alcoholic drink, considerable as I know that evil to be."

The economic side of the question is brought out—and these hard times, high prices of meat, etc.—will be duly appreciated.

The results of this investigation confirms the statements of hygienists that our diet is one-sided, and that we eat too much non-nitrogenous foods (fat and carbohydrates) and too little nitrogenous foods (called protein by Mulder, who supposed it was formed first in the vegetable, before being appropriated by animals) the elements going to make up muscle and tissue.

A portion of our agricultural press seem to belittle the importance of this bulletin; but health is of as much importance to our farmers as wealth. Very few persons expect to drink clean water if taken from a dirty vessel, and if our bodies are diseased is it logical to suppose that our mental vigor (respond-

ing as it does to a greater or less extent to our physical condition) will not be affected thereby?

An examination of the tables given in the bulletin gives the reader the idea that more actual nutriment in the shape of muscle and tissue-forming materials, as well as the heat-producing materials (with one exception—salt pork), can be purchased for 25 cents in the open market than by buying any of the three "F's"—fish, flesh and fowl.

> "A stated diet, as it is well known,
> Of Physic is the strongest corner stone,
> By means of which if you can naught impart
> Relief, or cure, vain is your healing art."

Daily dietaries are given for those who wish to try "the balanced human ration," but we regretfully note the absence of fruits in these tables. Let us hope, however, that no irrigation farmer's table is not liberally supplied with all fruits in their season, and that he needs "No spice but hunger; no stimulant but exercise."

Yield of One Acre.—An acre of land is 4,840 yards, or 43,560 square feet. The growing of trees on an acre requires little capital, skill or labor, but a great deal of patience, and on the average yields results of $2.25 per annum.

It is estimated that in New York state an acre will give the following net returns:

Rye, $8.50; oats, $11; wheat, $15; barley, $17.50; corn, $18; peas, $67; sweet potatoes, $75; spinach, $80; watermelons, $81; grapes, $122; muskmelons, $158; asparagus, $183; currants, $120; cabbage, $133; beets, $150; peaches, $150; strawberries, $150; tomatoes, $165; celery, $214.

Of course the results for such crops will vary according to the adaptability of the land, nearness to market, etc.

Taking the average width of a railroad bed at ten feet, 4,356 linear feet of track would be an acre. This is more than four-fifths of a mile of track. The Pennsylvania railroad system earns $15,000 per mile net, or $12,500 per acre. An acre of land in the center of large cities is still larger, however. The New York *Sun* estimates the annual revenue from an acre of land in the first ward of the city of New York, on a 5 per cent. basis, at $50,000.

Planting Unripe Seeds.—Southern farmers have found that they secured a larger crop of (tubers) Irish potatoes for their fall crop, when they used the unripe potatoes grown in the spring as seed. The same thing has also been found true with tomatoes.

The Indiana experiment station, after a series of experiments with tomato seeds, finds that "the principal deviations arising from the use of immature seeds are:

1st. A loss of vigor, shown in the smaller per centage of germinations, weakness of the seedlings and greater number of the plants which die before maturity.

2d. Failure to recover lost vigor, although the plants may, and usually do, produce an abundant harvest, and one acceptable to the cultivator.

3d. The increase of reproductive parts in proportion to the vegetative parts, resulting in a greater number of fruits and seeds (although individually smaller), and more rapid ripening than in similar plants from mature seeds."

Eucalyptus.—The Eucalyptus tree is often recommended as valuable for planting in marshy districts, on account of the hygienic effect in regard to malaria. Experiments seem to point that this effect is probably due to the abundant roots drying the soil, rather than to exhalations from the tree.

A Fine Apple.—One of the finest apples grown is the yellow Newtown, and that it is favored abroad was shown recently when this variety was quoted in England at 45 shillings per barrel, while Baldwins were quoted at 26 shillings. As to the Ben Davis, it is not to be compared with the various varieties of pippins, the Spitzenburg or the Baldwin; its main drawback is that it is pulpy and flavored on the order of a turnip. The blue paramin is too weak in the stem for a country liable to much wind.

Protection from Frost.—A new wrinkle, the protection of tender vegetation from the danger of the late spring frost, has been tried by a man in Ontario. He describes his scheme as follows: "When threatened with a heavy frost at night I set my spray nozzles so as to cover as large a space as possible, and turned on the water. It ran all night and in the morning there was ice in the paths, but not a particle of even the most tender vegetation was touched. This plan will keep off the spring frosts, which are very destructive in some places. Where one has waterworks to draw on the season can be extended almost six weeks, for there is seldom more than one bad frost at a time, and that can be defeated by spraying." Another man in Western Colorado says that he keeps off the spring frosts by turning on the water in the ditch and flooding as much of his orchard between the rows as he can conveniently cover, following the irrigation with light surface tillage to keep the moisture in the ground.—*Exchange.*

The Stages of Chicken Life.—The time of incubation is, for hens, 21 days; for ducks, the Muscovy excepted, 28 days; turkeys, 28 days; Muscovy, 30 to 35 days; geese, 30 to 35 days. In this climate, however, when perfectly fresh eggs are set, say eggs within a week old, they hatch within a day earlier of the ordinary time. And sometimes, when mixed eggs are used, two days longer are invariably needed for incubation. Those that take the longer time are seldom as robust as could be desired.

Sugar Beets.—The average yield of sugar beets in Colorado when grown by irrigation and cultivated in the right way may be placed at twenty-five tons to the acre, and the cost of production can be generally estimated at $30 an acre, although the work has been done in Nebraska at much less than this. The sugar manufacturers at Lehi, Utah, say that sugar making cannot be made a success in any country until farmers learn how to grow the beets, and this learning will require three years of actual experience. This being the case, the farmers of Colorado ought to begin beet culture at once and make a practical study of the business, for within three years we are more than likely to get a factory well under way somewhere in the State.

Wide Tires.—The following wide tire test was made at the Ohio State University. An ordinary wagon with a new 3-inch tire was loaded with two

long tons, or 4,480 pounds, and the draft was measured by a dynamometer. On an ordinary earth road in good condition and hard the draft was 254 pounds. On a grass field it was 468 pounds. On newly plowed land it was 771 pounds. As the draft power of an ordinary horse of 1,000 pounds is 150 pounds, two horses could draw this load with ease on an ordinary road, and a ton and a half on a grass sod, while with a narrow tire half as much, or a single ton, is a full load for a double team. Besides this, the broad tires roll and level a road, so that the more it is used the better it becomes, while narrow tires cut it into ruts if at all soft.

Orange Wine.—A correspondent in the *American Carbonator* gives the following recipe how to make orange wine:

Take one part orange juice, well strained; one part water; three pounds sugar per gallon. Any kind of sugar will do, and the darker the sugar the richer will be the color of the wine. For each ten gallons put up, keep one gallon of the same for refilling the cask during fermentation. Lay casks on the side, fill full and leave bung open. Do not let it be exposed to too much cold. Fill up the casks every day from the quantity kept out, as the scum is thrown off, and watch closely until the wine passes the stage of alcoholic fermentation. This will usually require from ten to twenty days, and can easily be determined by its ceasing to rise and the cessation of brisk fermentation. When it arrives at this stage, place the bung in loosely. Watch closely for a few days, and as active fermentation ceases, put the bung in fast. Let it stand two months and then rack off carefully into clean casks. If perfectly clear, seal and let it stand six months, when it may be bottled. If not clear, it may be racked off a second time, two months after the first time, and sealed six months before bottling. Be sure your casks are full, for contact with the air will cause the wine to pass into acetic fermentation.

This article finds a ready market at $5 per gallon.

Strawberry Growing.—Prof. Lazenby, before the Columbus Horticultural Society, gave the following summary of essential points to be kept in mind:

1. The most profitable varieties for the commercial grower are those not easily influenced by differences of soil and climate. Those which succeed well on wide areas are usually better than those which have a more local reputation.

2. Pistillate varieties, when properly fertilized, are more productive than the sorts with perfect flowers.

3. The value of a variety for fertilizing pistillate flowers does not depend so much upon the amount as upon the potency of the pollen.

4. The flowers of pistillate varieties are less liable to be injured by frost than the flowers of perfect varieties.

5. Varieties that are neither very early nor very late in point of maturity, are the most productive and have the longest fruiting season.

6. As a rule, varieties that have the most vigorous and healthy foliage are the most productive, while those with a weaker growth of foliage and a greater susceptibility to leaf blight are usually more prolific.

7. Winter protection may be dispensed with upon well-drained sandy soils, but appears to be a necessity upon heavier ones.

8. The leaf blight may be checked by using the Bordeaux mixture, beginning just as soon as leaves appear, and continuing the application every few weeks throughout the season.

Bacterium Peptofaciens is the name of a new milk bacteria, which changes more than half the casein into albumen and peptone. Some lactic acid and acetic and butyric acid was produced, but no gas even after a week. It is claimed that the bacteria can be practically used in peptonizing and rendering soluble the casein in milk, thus producing an easily digested food.

Ripening Cream by Bacteria.—Prof. Conn of the Connecticut station, is experimenting with fourteen species of bacteria found in Connecticut creameries and several others from Europe.

One species has been furnished to three creameries, one in Cromwell, Conn., for nearly four months and the others several weeks. The managers report most gratifying results. The use of the bacteria furnished the Cromwell creamery has greatly improved the quality of the butter.

Cause of Blue Spots in Cheese.—The results of experimentation in Holland tend to the belief that this is not caused by bacteria (worth noting these times when bacteria is the *bete noir* of all), but by a large percentage of iron. The iron may have got into the cheese by using ferruginous water or rusty utensils.

Lactola is an artificial milk. One hundred gallons of skim milk is boiled in a vacuum pan with 50 to 200 pounds of sugar until evaporated to one-third or one-fourth of its bulk. It is then put into another pan, where 1½ to 2 ounces of refined cotton-seed oil is added and the whole mass thoroughly mixed.

Graham Bread.—The German chemist Bardet, as a result of experimentation, regards Graham bread as a suitable substitute for meat. When properly prepared it contains 40 per cent. of gluten (a muscle former) as compared with 25 per cent. in rye bread.

Tydeus Molestus.—During 1888 the mite "tydeus molestus," a new species of acarid, became very abundant in gardens not far from Ath, Belgium, where it had been noticed in smaller numbers for twenty-five years. In passing through the gardens and brushing against the vegetation one becomes covered with the mites, which produce an irritation similar to that of the larval trombidiums, called jiggers or red bugs. The mites also attach themselves to domestic animals, about the joints, the eye and the anus. Young ducks suffer greatly from this parasite, and are even killed by its attacks. The remedy proposed was to plow up the garden several times during the summer, and uprooting all shrubs and plants with hairy leaves.

Desicated Milk is a yellowish-white powder, made in Prince Edward Island, from evaporated milk, to which a quantity of cane sugar was added. It is claimed this powder may be preserved in good condition and palatable for a length of time, even though exposed to the atmosphere.

Analysis showed—

Water	5.44 per cent.
Fat	21.73 " "
Albumoids	18.01 " "
Milk sugar	25.22 " "
Cane sugar	26.45 " "
Ash	63.15 " "

Louping-ill in Sheep.—Nine inoculation experiments were made with pus cultures taken from two diseased sheep. In two cases it seemed the disease was caused by a specific organism, whereas in the other seven cases the results were negative.

Wild Cherry.—Prunus besseyi, the native wild cherry growing on the plains west of the Mississippi and on the mountains of Colorado and Utah, is considered worthy of effort towards its improvement. The fruit of this cherry is about one inch in diameter, flavor usually aromatic but inclined to be bitter or astringent.

More About Feeding Wheat.—The following recommendation of the Ontario Agricultural College is the result of two trials of feeding wheat to milch cows. The ration is four pounds ground wheat, four pounds wheat bran, six pounds of hay and fifty pounds of silage. "We would recommend dairymen to try a ration of wheat and bran, or wheat and oats, during the winter, and if it is fed to the right kind of cows, and the product handled properly, we feel confident that it will pay better than selling wheat at late prices."

A Precocious Milker.—The udder of a heifer fifteen months old had so developed that she was milked. In appearance it was very watery at first, but kept improving. The most interesting part is the fat content of this milk-like secretion. The first time she was tested—on the 7th of July—the per cent. of fat was 0.4 per cent. On July 8th she tested 1.2 per cent., showing a marked increase in this short time. July 12th she again tested 1.2 per cent. When first milked she had not been bred, but in a day or so after she was mated. November 10th the yield had decreased to about a pint a day, but the fat had increased to 3.8 per cent. So far it has not apparently affected her health or growth.

Egg Fertility.—Forty Leghorn hens kept on the Ohio State University farm, without males, were placed in pens with three male birds February 18th, and the per centage of fertile eggs observed for nine days after mating. This increased regularly from 0 on the day of mating to 95 per cent. on the eighth day thereafter. July 1st the males were removed from the pens. The fertility of the eggs was apparently not materially affected until the twelfth day after removing the roosters.

More Beans.—The South is advised to raise more corn, and the whole country may safely add to the acreage in beans. Nearly a million bushels of beans were imported last year, and advancing prices show that this is a neglected crop.

Bee Forage.—Alba melilotus, or sweet clover, will grow anywhere on the plains without irrigation, and makes the best bee forage that can be grown under similar circumstances, with the possible exception of our native cleome integrifolia or Rocky Mountain honey plant. Sweet clover does best on alluvial soil, and is a troublesome weed in a good many instances. We never advise its growth in places where alfalfa will thrive.

Proper Cooking of Vegetables.—The large sweet onion is very rich in those alkaline elements which counteract the poison of rheumatic gout, says the *Medical Record*. If slowly stewed in weak broth and eaten with a little Nepaul pepper will be found to be an admirable article of diet for patients of studious and sedentary habits. The stalks of cauliflower have the same value, only too often the stalk of a cauliflower is so ill-boiled and unpalatable that few persons would thank you for proposing to them to make part of their meal consisting of so uninviting an article. Turnips, in the same way, are often thought to be indigestible, and better suited for cows and sheep than for delicate people, but here the fault lies with the cook quite as much as with the root. The cook boils the turnip badly, and then pours some butter over it, and the eater of such a dish is sure to be the worse for it. Try a better way. What should be said of lettuce? The plant has a slight narcotic action, of which a French woman, like a French doctor, well knows the value, and when properly cooked it is really very easy of digestion.—*Fruit Grower.*

Bermuda Grass.—The following methods of culture have been found satisfactory for destroying Bermuda grass:

1st. Plow the land with a heel sweep at intervals of from one to three weeks throughout the season. 2nd. Growing a crop of oats and afterwards following with the above treatment for the balance of the season. 3rd. Growing a crop of oats, and for the balance of the season plowing every one to three weeks with a scooter plow. 4th. Growing a crop of oats and following this with a crop of cow peas planted in drills 2½ feet apart and cultivated twice. Bermuda grass is a valuable forage plant, but owing to its habit of taking root at every joint is not popular in the South and Southwestern States.

The thoroughbred stallion is valuable for the runners he will produce. It isn't so with the strawberry plant that is to bear a quart of berries next year. The runner runs away with the plant's vitality.

The cow of prosperity will not of her own accord back up to you to be milked. She must be coaxed and tempted with something substantial. If you approach her from the wrong side you are liable to find yourself on your back in an adjoining lot; if from behind, better call the hospital ambulance at once and go in for repairs.

THE QUESTION BOX.

The Question Box shall be an "open parliament" for the discussion of the practical, every-day questions that perplex the irrigation farmers. Questions will be answered by those men of long experience among our readers who are glad to give of their knowledge for the common good. Further answers are solicited from any reader whose experience differs from that published here. THE AGE reserves all rights of control of the department.

Cauliflower.—What is the best cauliflower to raise for market under irrigation? What culture should be given cauliflower under irrigation different from that in the East? How often should cauliflower be watered? What are the best fertilizing materials for raising cauliflower under irrigation?

WM. C., Arizona.

Vick's ideal is one of the best cauliflower I know of to raise for market under irrigation, the early Snow Ball the next best. The ground should be heavily manured in the fall and plowed in deep, then plowed and harrowed twice in the spring, the plants set in rows 2½ feet apart and 1½ feet apart in the row, and as soon as dry weather commences they should be irrigated every eighth or tenth day by running the water in furrows eight inches from each row, and the second day after watering they should be well cultivated, so as to keep the ground mellow. After cultivating make the furrow for watering again. Continue this labor till the plants begin to cover the ground, when the ground wont need stirring after irrigating. Don't let the water get out of the furrows and flood the ground, only use water enough to run slowly, so as to soak the ground good.

Respectfully yours, GEO. L. FARRELL,
Smithfield, Utah.

Fertilizing Crop.—What crop would you recommend me to grow for plowing under as a green manure? Would crimson clover be a good crop for green manuring under irrigation? How about Southern cow peas or Essex rape for this purpose? I have grown oats in Florida as a catch crop to plow under, but would like the experience of others on this matter. J. S. T., Colo.

Try sowing a bushel of sorghum seed per acre (the black amber is probably the best), give it plenty of water and turn under the crop before any seed forms. I have not tried this myself, but it is claimed that remarkable results may be so obtained. Certainly no other crop will supply such a mass of green manure with so little expense and labor. Alfalfa is an excellent crop for enriching the soil, both as one of the series in a set rotation and as a green manure, but it is a hard crop to turn under, on account of the mass of strong roots, and only the cleanest plowing to a good depth will prevent its proving a bad weed where it isn't wanted. I know nothing about the merits for fertilizing purposes of the crops mentioned by your correspondent. J. W. GREGORY,
Garden City, Kan.

Japanese Persimmons.—Are Japanese persimmons a profitable crop to raise under irrigation? What variety would you recommend, suitable for shipment to San Francisco?

H. R. W., California.

The Kaki, or Japan persimmon, has proven a profitable crop in Florida, and would probably be fairly profitable if properly handled in California. Mr. Luther Burbank of Santa Rosa, Cal., informs me that they have not generally paid as well as some other fruits, and that they fruit in greatest abundance and perfection there without irrigation. The following are among the best varieties:

Castata.—Medium size, conical, skin salmon yellow; flesh light yellow; astringent until ripe, then very fine; late and keeps well.

Hyakume—Large, varying from roundish oblong to roundish oblate; skin light buffish yellow; flesh dark brown; sweet, not astringent; good keeper; one of the best market sorts.

Okame.—Large roundish oblate, with well-defined quarter marks, point not depressed; skin orange yellow, changing to brilliant carmine; waxy, translucent appearance; light, clear flesh when ripe, with ligh brown center around seed; loses its astringency as soon as it begins to ripen.

Zeuge.—Small, round or roundish oblate; skin yellowish red; flesh very dark; seedy; edible when still hard; one of the earliest to ripen. Tree vigorous and a good bearer. C. B. CHANNEL,
Nebraska.

Squashes.—Would it be profitable to raise squashes for market near here (Merced, Cal.); if so, what varieties would you recommend? What cultural methods are best for this crop, under irrigation? How far should they be planted from melons to prevent hybridizing? S. A. McM.

My method of raising squash is to prepare ground about the 20th of May. I put a small shovel full of hen manure under each hill, by throwing out a shovel full or two of dirt to make a hole; then I put in the manure, then dirt on the manure; put in five or six seed on dirt, then cover dirt over seed, then irrigate them. When up, pull all out of the hill but the three strongest plants. I put hills ten feet apart each way; three rows of corn or anything else between squash and melons; they will not mix.

Now as to culture. I cultivate twice between each irrigation, and I irrigate three or four times during season. As to kind, I plant the Hubbard, as they do best, keep best, sell best, and pay to raise. I can make money at raising and sell at $1 per wagon load. It is surprising what amount can be raised on an acre. I am planting six acres this season in my orchard. AARON WALTERS,
Colorado.

Farmer: "James, have you watered the cows this morning?"

New man from the city: "No, sir; not for two days——"

Farmer: "What!"

New man from the city: "I—I—heard you say day before yesterday, sir, that they wouldn't be dry for about six weeks yet, sir."

"If anybody iver catches me stroikin'," said Mr. Dolan, "'twill be whin Oi'm out av impl'yment, an' hov nothin' betther to do."

The recording angel (to assistant): "Say, bring me a pot of ink and a dozen new quills."

Assistant: "Why this unwonted preparation, oh thou with sharp ears?"

The recording angel: "Why, here's a fellow who has just got home from Europe, going to meet some friends and tell them all about his trip."

MAXIMS FOR THE IRRIGATED FARM.

Don't put yourself on the shelf.

Get a move out of that groove.

It doesn't take a strong man to break his own pledges.

The power to kick is in the heel not in the head.

The fruits of a successful life grow on the tree of economy.

All men praise patience, but few can practice it.

Trifles make perfection, and perfection is no trifle.

A man is his own star;
Our acts our angels are
For good or ill.

A "stiff upper lip" seldom belongs to a man who has a limber tongue.

The "sweet by and by" is not likely to come to those who are continually sour now.

The breeding of your children is of more importance than the breed of your hogs.

Contentment consists not in great wealth, but in few wants.

The friend of everybody is often a friend to nobody.

Cupid doesn't fatten on a steady diet of corned beef and cabbage.

A million dollars in gold can't buy a meal for a hungry heart.

To women there are three kinds of men—men, lovers and husbands.

Various facts go to show that a man's age may be as ripe as the man himself is green.

Courtship is seldom a training school for what comes after.

A wise woman will never marry the man who believes that the wife should be entirely dependent upon the husband.

Some men put into their pocketbooks much more than their money.

It is a dangerous business for men and women to lie to each other until they are married.

There is a time to do as others wish, and a time to refuse.

Early rising in the morning makes early retiring in the evening pleasant.

The man who is not content with little is content with nothing.

Every bird has its decoy, and every man is led and misled, in his own peculiar way.

That man is not capable of caring for his own soul who is too thoughtless to care for his horses.

It is as natural for us to grumble as for a horse to shake his head when flies tease him.

Spend not all you have; believe not all you hear; tell not all you know, and do not all you can.

When we give ourselves to vice the glass of time runs mud;
When we live by routine it runs sand;
When we are bent on improvement it runs gold dust.

The bee, though it finds every rose has a thorn, comes back loaded with honey from his rambles; and why should not other tourists do the same?

He who is his own monarch contentedly sways the sceptre of himself, not envying the glory to crowned heads of the earth.

To watch the corn grow, or the blossoms set; to draw hard breath over the ploughshare or spade; to read, to think, to love, to pray, these are the things that make men happy.

"Sometimes," said Uncle Eben, "er man's ter'ble skyaht 'bout hidin' 'is light undah er bushel when er pint cup 'ud answer all de purposes wifout no trouble 't all."

The best results on the farm are attained where study is allied with practice. An exact knowledge of facts relating to agriculture, has a tendency to eliminate unreasonable prejudice by the substitution of rational practice.

Write out a list of your wrongs. Look them in the face. You will be astonished to see how many of them can be righted by righteous conduct on your part.

Plant lice are bad enough, but plant *lies* are worse. That's what you do when you teach the child (by example) to deceive. You need a spraying with praying.

Tottie (aged five): "I wonder why babies is always born in the night time?"

Lottie (aged seven, a little wiser): "Don't you know? 'Cos they want to make sure of finding their mothers at home."

As the Dutchman translated it: "The ghost is willing, but the meat is feeble."

Farmer: "I bought some stock in that Western Land Company."

Broker: "Wasn't it watered?"

Farmer: "That's what I understood; but they've been assessing me like the mischief for irrigation purposes."

"Who was the inventor of the modern cigarette?"
"The fool-killer."

"Beware the microbes in a kiss!"
Cold-hearted science cries.
Alas! where ignorance is bliss,
What folly to be wise."

Exciting fights and brawls, I trow,
May flow from pleasure's cup;
But it takes the farmer with his plow
To stir the country up.

A little girl's father had a round bald spot. Kissing him at bed time not long ago, she said: "Stoop down Popsy; I want to kiss the place where the lining shows."

"What do you think of these eggs?" whispered the lean boarder, "These eggs," responded the fat boarder, whose occupation is that of advertising clerk in a newspaper office, "are too late to classify."

American little girl to her mamma: "What is a dead letter, please?"

Mamma: "One that has been given to your father to post."

Squander, and friends flock 'round you,
They leave when your money's gone;
Drink, and the world drinks with you;
See snakes, and you see 'em alone.

PULSE OF THE IRRIGATION INDUSTRY.

A. H. FORD, OF CHICAGO.

THE question of preventing concentration of population in large cities is one which has always interested those students of human nature who are constantly trying to evolve some plan whereby humanity can be benefited. These men are working not for themselves, but for others, and they have given the social problem much thought and study, with the result that it is almost unanimously admitted that misery, degredation and poverty are inseparably connected with the hoarding of large masses of population within the close confines of cities, and therefore the establishment of small villages and farm colonies has been advocated as one of the best methods of assisting men to be independent as well as giving them an opportunity to live under much better social conditions.

Mr. Alexander H. Ford, the editor of the *Home Seeker's Journal*, whose portrait appears elsewhere in this number, has been one of the moving spirits in organizing public sentiment on these lines in Chicago. After much hard work he succeeded in interesting prominent clergymen, business men and the officials of the various labor unions in the matter, and the Home Seeker's Association was established. This association is doing a very good work, and furnishing reliable information to those who are interested in the resources and possibilities of the West and South for the intending settler. Mr. Ford is the second vice-president of the National Colonial Club, of which Dr. Edward Everett Hale, of Boston, is first vice-president, and while Dr. Hale is guiding the 40,000 people who leave Massachusetts every year, Mr. Ford, in Chicago, is gathering facts about the whole country to place before them, that they may intelligently decide where they wish to locate. Being a southern man, Mr. Ford is naturally greatly interested in everything pertaining to the South, but not to the exclusion of western affairs. Having traveled throughout the entire West, he is well acquainted with the country, and he realizes that it possesses advantages in certain respects that are unequalled anywhere. At the recent meeting in the Auditorium Hotel, in Chicago, of the general passenger agents of the southern transportation lines, the leading representatives of the land companies, and many other prominent gentlemen, Mr. Ford advocated the formation of a Chicago southern association, and his suggestions were embodied in the plafform of the organization.

Mr. Ford has had a wide newspaper experience, having been connected with several of the leading daily papers of New York and Chicago, and he has also had a good opportunity to gain an insight into the methods practiced on Wall street, as he was for five years engaged in promoting the interests of various southern and northwestern railroads on that world-famed exchange.

MEN, MONEY AND MORTGAGES.

IRRIGATED land in the "Great Arkansas Valley," (called by Senator Ingalls the valley of the American Nile), pays an annual net profit of $20 per acre and upward on alfalfa and $50 to $200 per acre and upward on fruits and vegetables.

I control a quantity of best irrigable land, which can be bought in small tracts at $20 to $40 per acre, and furnished with irrigation pumping outfit for not exceeding $15 per acre. This amounts to a perpetual water right, and annual cost of maintenance is very small.

Fifteen years' experience in farming here by irrigation, and our farmers grow successfully more than fifty kinds of temperate zone crops—all the leading fruits, grains, vegetables and forage crops. Great alfalfa country, both for seed and hay. Fine success with all kinds of stock, poultry, bees and fish. Good schools, churches and railroad facilities and fine roads the year round. Remarkably healthful climate and mild, open winters.

HOMES FOR 100 FAMILIES

on terms within the reach of any man having from $300 to $1,000 cash to start with. Deferred payments for those who cannot pay all cash will bear seven per cent. interest.

These lands are becoming very valuable, and parties who wish to secure a cheap home where success is certain will need to act promptly.

I desire the coöperation of such persons as will assist in settling worthy people on these lands, also

PURCHASERS FOR SEVEN PER CENT. MORTGAGES

representing deferred payments on same. Strictly gilt-edge securities.

Will pay all expenses of round trip of any person who will come here and see for himself, who does not find everything as represented.

Call on or address J. W. GREGORY.
Garden City, Kans.

PLYMOUTH COLONY.

THE committee appointed to visit the site of the Plymouth Colony in Idaho have returned to Chicago and made a full report of their investigations. The committee found that the resources and possibilities had been somewhat under estimated and they are all very well pleased with the prospect. The following is a brief abstract of their lengthy report:

"The colony site is on the second bench above the Payette river, about four miles in a direct line from Washoe and six miles from Payette. The land is covered with sage brush about four feet nigh, and there are no indications of alkali. The soil is loam with a slight admixture of sand. It varies from ten to thirty feet deep. Some of the principal irrigation laterals have been built and a little of the sage brush burnt off, but the colonists must calculate on having to clear away the sage brush and build most of the laterals. The expense of building the main laterals will be about $20 a mile, or $2.00 for each 20-acre tract. The small ditches can be made with a plow. The colony site is entirely free from stones of any kind except those which are dug from wells. The drinking water from the wells on the colony site is cool and soft. The wells average forty feet deep and cost about $1.00 a foot to dig without being curbed. Curbing seems to be unnecessary. About 120 acres

of the colony tract are now being planted in corn, and 180 acres of orchard has been planted this year on the bench.

"The water supply for the colony is obtained from the Payette river, which is a large stream rising about 120 miles above the tract in the Sawtooth mountains. The volume of water at its lowest stage is sufficient to irrigate 240,000 acres, whereas, not more than 80,000 acres are susceptible of irrigation in this valley. The head gates and banks of the canal are substantially constructed, and it was fully completed in 1893. The Plymouth committee investigated prices of land adjoining the colony tract, and find that in all cases it is valued much higher than it is proposed to sell this land to colonists.

"The climate was found to be dry and healthful, and Dr. Delano, in charge of the sub-station of the U. S. Weather Bureau, stated to the committee that the warmest day since the station was located, six years ago, was in August, 1894, at which time the thermometer registered 110 degrees, and the same night it was 68 degrees, which was also the warmest night. The coldest day during the same period was 20 above zero, and the coldest night 8 below zero. The first killing frost in 1894 was October 7th, but after this for six weeks the temperature did not reach the freezing point. The committee traveled about sixty miles up the valley in an open buggy, with the thermometer standing at 85 degrees in the shade, without any particular discomfort. When in the shade they found it delightfully cool and pleasant. The committee found the markets were practically unlimited, as the colonists would be able to dispose of their products in the numerous mining towns in the vicinity. Mr. A. B. Moss, the leading merchant of Payette, estimated that over eighty car loads of canned goods are shipped into Canyon County and the four counties adjoining, every year.

"There are large forests at the head of the Payette river, and lumber can be obtained for about $10 per thousand feet for common, and $20 per thousand for the best flooring, etc. Cordwood in quantities is worth about $3 per cord. The coal fields are found to be only slightly developed, though a tunnel about 200 feet long has been driven under the hill, with a side drift thirty feet long. The veins vary from a few inches to four feet in thickness.

"A number of the settlers of the valley were interviewed, and some of them state that they arrived several years ago with but $25 in money and no other property. After working at various occupations for a year or two and saving a few hundred dollars, they bought places of their own and now have orchards started and are making a good living. On Mr. Schmidt's farm seven hogs and eleven sucking pigs were seen living on a half acre of alfalfa, with no other food except leavings from the table.

"The committee revised the figures on the cost of farming implements, clearing and cultivating land, building a house and planting seeds and trees. They found that $850 instead of $1,000 would be amply sufficient.

"They are particularly pleased with the plan of the association in farm villages and the establishment of allied industries, as these are especially adapted to avoid the discomforts and hardships incident to locating in a new country, and insuring a market for the products of the farms and orchards."

I have been growing garden vegetables for family use for four years past by the aid of well water.

My soil is dark sandy loam.

The well is twenty-five feet deep, and water is raised by means of an ordinary force pump, with 3¼ x 14-inch cylinder driven by an eight-foot steel Perkins mill.

The first two years the garden was confined to a plot, 50 x 50 feet square, fenced in to protect it from the chickens.

This was "new" ground and was heavily fertilized with stable manure and wood ashes. The ground slopes a very little toward the north and the things were planted in rows north and south. There were onions, peas, beans, lettuce, radishes, peppers, tomatoes and cabbages.

The ground was literaly covered with plants.

The water was made to flow along the upper side of the garden and then down between the rows of vegetables. The water was allowed to run until the ground was wet. As soon as the surface was dry enough to permit we gave it a hoeing to loosen up the surface. This was found to be very necessary, until the cabbage and tomatoes got big enough to shade the ground, then the hoeing was necessarily omitted among them. The cabbages and tomatoes occupied each one fourth of the ground and were a sight to see. The cabbage heads, not leaves, touched each other along the rows. The tomatoes began ripening in June and continued till after frost. During the better part of the season we gathered an ordinary water bucket full of tomatoes per day.

Since then I have tried watering on larger patches of cabbage and on sweet and Irish potatoes, and have had fair crops, when those on unirrigated land were total failures.

Last season, 1894, we set out 1,000 cabbage plants. The ground was very dry, dusty in fact, as deep as it had been plowed.

When ready to set the plants, I took a common twelve-inch plow and turning well over to the land side, laid the patch off in furrows. Then turned the water into the furrow and let it flow to the lower end. By beginning at the lower end and making little check dams with the hoe, I soon had the furrow full of water. When this had settled I set the plants in the mud and drew the dry dirt around them with the hoe. These plants were set in the afternoon and not protected from the sun the next day, but they never wilted and hardly stopped growing at all.

Without water gardens are poor property here, but every one who has a good well can have all the garden "truck" the family can consume and can also gather in many an extra dollar from the surplus.

It seems to me that one mistake we Kansans make is in not trying this matter in a small way. There are many farmers who, when asked about the matter, say: "O, yes, we would irrigate if we could water 80 or 100 acres, so it would amount to something;" and these same men buy their potatoes, tomatoes, cabbages and such stuff at the store, and their families have to do without the more dainty and desirable fruits and vegetables.

We have good soil and sunshine to spare; all we need is an awakening of our farmers to the wonders that can be accomplished by applying water and energy to the soil. This would, on a very small plat of ground, furnish a living, and then the cattle and wheat would make us rich. W. V. JACKSON.

Coldwater, Kans.

ARIZONA.

In the district court of this district, Chief Justice A. C. Baker presiding, evidence is being taken in a water case that is of supreme interest to all water users in Arizona.

It involves the validity of the prior appropriations of water made by the early settlers through the oldest canals in the valley, as against the claim set up by a canal more recently constructed.

The plaintiffs estimate that it will take twenty days for them to examine their witnesses alone, and it is likely that the defendants will consume nearly as much time with theirs.

It is the first time the matter has ever been brought to an issue, and it is the earnest wish of every one that it be settled now, and that every man's right be established, once and for all.

One day last month the new Marion dredger on the Maricopa Canal caught fire, and was burned to the water's edge.

It is quite a serious loss to the canal company, but itwill be rebuilt at once, and the work of enlarging the canals continued to completion.

Col. C. H. Gray, who is one of the earliest pioneers of the valley, recently made a sale of his famous Arica gold mines, which lie just beyond the Colorado river, to A. M. Wells, the representative of a Denver syndicate ot capitalists.

Col. Gray has one of the loveliest homes in all Arizona surrounded as it is with noble shade trees and a rose garden that is hard to match, and his many friends are pleased at his success in compelling the hills to give up their wealth for the benefit of the toilers in the valley.

Since the opening of the Santa Fé, Prescott and Phœnix railroad the shipments of all kinds of farm produce has been more than doubled, and at the present time nearly the entire supply of grain, hay, flour, beef, pork, vegetables and green fruits used throughout the northern part of the territory are drawn from Phœnix. This trade is the natural heritage of Phœnix, and in the near future it will make her the metropolis of the great southwest.

Several camping parties are arranging to spend the summer at the Grand Canyon north of Flagstaff.

This is a trip well worth making to any one who loves an outdoor life, for the Canyon is a sight not to be seen elsewhere.

The fruit crop promises to be abundant and of good quality. At present strawberries are being shipped in every direction at prices that net about eight cents per basket to the growers.

May 3d was the date chosen by the combined Sunday schools of Phœnix for a picnic to the historic Hassayampa. Every idle car that the new railroad possessed was filled with the joyous children and old folks, and when the two train loads of humanity reached their destination it was found that over 1,500 souls had availed themselves of the opportunity to visit the stream that is as famous in the annals of Arizona as the Hudson is in the history of New York.

The enterprising citizens of Flagstaff are working on a proposition to establish a summer school for Chautauquans, with almost a certainty of its being accomplished. The location is unequalled for the purpose and the climate is superb, combining the altitude and temperature of the mountains with dry, balmy air from the plains below. That it will have the enthusiastic support of all Arizonans goes without saying.

Prescott is to provide amusement for the rest of the territory the 4th of July, and a jolly time is looked forward to by the web-footed alfalfa growers of the valleys. When the people of the pine-clad hills of Yavaipai start out to do anything it is usually done in a creditable manner, and in this instance they propose spending $6,000 to amuse and entertain their visiting brethren from the surrounding towns of the territory. Hurray for the glorious 4th of July!

CALIFORNIA.

The Escondido Irrigation District has just completed its main line, and on April 23 turned the water of the San Luis Rey river into the storage reservoir. The dam is now complete to the forty-five feet contour, the ends being built to the full height of seventy-five feet, and it is expected that the dam will be finished in time to store about sixty feet of water this year.

Work is being pushed on the distributing system, and water will be supplied to a part of the district 00 less than a year from the beginning of work. $250,0of have already been expended, and $100,000 more in bonds contracted for to complete the system.

E. F. Tabor is the district engineer.

IDAHO.

Messrs. Frank J. Riblett and Skidmore have returned from Snake river, their search for a bridge location having proved highly satisfactory. A number of measurements were made at different points between Marsh creek and Story's ferry, but the most favorable site of them all was at the latter place. Here the river is of far less width than at any of the former places, besides at this point there is a solid rock bottom to the river upon which to build butments, etc. At Story's ferry the low water measurement is 450 feet and high water measurement 540 feet. At one place in the river, at this point, there is a deep channel, but its width is only about 150 feet, just an easy span, while for the balance of the distance across the water is very shallow.

MONTANA.

Seeding is almost over on the ranches. Things are looking well. The season has been a little dry, but with our abundant supply of water for irrigating purposes there will be no trouble in raising a fine crop.

Prospects are fine for an abundant crop of fruit, especially apples; trees just blossoming out.

The Western Montana Fruit Growers' Association has been incorporated, and will hold their annual exhibition in Hamilton in September.

There is considerable ranch property changing hands, parties coming from the East buying homes in an irrigating country where they can be sure of growing a crop.

There are no large or expensive irrigating canals in this valley, with one exception. So many small creeks put into the valley from the mountains, the water drawn from them, instead of from large canals from the river, makes it quite inexpensive for the ranchers to get their water supply for irrigating purposes. This is one of the best watered valleys in the whole mountain country.

A large number of fruit trees are being planted here this spring.

WYOMING.

The boom in the oil business is rapidly drawing the attention of investors to the splendid oil fields of central Wyoming. The supply in the old fields of Pennsylvania and Virginia is becoming scarcer year by year, and ere long we must look to Wyoming to supply our markets with both lubricating and illuminating oils. The oils found in that State are superior in quality to anything hitherto found, the crude oil having proved itself a better lubricator than any of the manufactured oils for use in machinery.

Prices now paid for oil at Casper, Wyoming, have been lately about $14 per barrel on the track, and the supply does not yet equal the demand. The business is in its infancy, only five wells being in operation, but ere long the wells will probaby be numbered by thousands.

With its vast oil deposits, its splendid rivers and valleys inviting the capitalist and homeseeker to build the wealth-producing irrigation canal, and its boundless resources in gold and other minerals, Wyoming is bound to become one of the wealthiest of our States.

There are many energetic men in Wyoming endeavoring to draw the attention of capitalists to the splendid opportunities of investment.

Amongst the prominent citizens of central Wyoming we may mention Arthur W. Phillips. Having located in the State in 1885, he is no new comer or "tenderfoot," and is thoroughly versed in everything pertaining to the development of his State.

He is a young man, but by extensive travel in all parts of the globe, and with the help of a good German and English education, coupled with a practical acquaintance with people of all nations, he has gained valuable experience which but few men of his age possess. He is now clerk of the District Court at Douglas, Wyoming, and edits and manages *The Central Wyoming News*, the official paper of Converse county, Wyoming. At present he is engaged in the development of the oil fields, in which he is largely interested, having a large share in over 120,000 acres of oil lands. Besides this he owns some fine farming land along the Platte river, and is a firm advocate of irrigation. Recently, on the formation of the Converse County Immigration Board, he was elected as its first secretary, and is now engaged in the preparation of a book on Wyoming and its wonderful resources.

100-H. P. GASOLINE ENGINES.

The Foos Gas Engine Company, of Springfield, O., are now manufacturing gasoline engines of 100-horse power. Having been engaged in this business many years they have learned by actual experience what is required of a gasoline engine, and at a great cost they have made many improvements. For a catalogue describing in full their engines, etc., send direct to the head office at Springfield, O.

GRAND CANYON OF COLORADO RIVER.

On the Santa Fe route, in Northern Arizona, 1,262 miles from Kansas City, is the town of Flagstaff. A tri-weekly stage line runs from Flagstaff to the Grand Canyon of the Colorado River. More than a mile in depth, this is the sublimest of gorges—a Titan of chasms. Twenty Yosemites might be hidden unseen below and Niagara would look scarcely larger than a brook.

Don't fail to visit this first wonder of the world. You can "read up" about it by asking C. A. Higgins, A. G. P. & T. A., A. T. & S. F. R. R. Co., Chicago, Ill., to mail you a free copy of an illustrated book describing this terra incognita. The book is no common affair; but is entertainingly written, beautifully illustrated and a gem of the printer's art.

TAKE YOUR SUMMER VACATION TRIP TO COLORADO AND YELLOWSTONE PARK.

The Burlington Route will run special cars, personally conducted tours, to Colorado and the Yellowstone Park, leaving Chicago June 26, August 7 and 14. First-class service. Low rate, including all expenses. For descriptive pamphlet, apply to T. A. Grady, manager, 211 Clark street, Chicago.

CLIMATE AND CROPS JUST RIGHT.

Oklahoma has thousands of acres of the finest farming land in the world, waiting for you or anybody else with a little cash and lots of gumption. Climate and crops are just right. Farms will cost more next year than this. To find out if this is the country you want, ask G. T. Nicholson, G. P. A. Santa Fe Route, Chicago, Ill., for free copy of Oklahoma folder.

SHORT JOURNEYS ON A LONG ROAD

Is the characteristic title of a profusely illustrated book containing over one hundred pages of charmingly written descriptions of summer resorts in the country north and west of Chicago. The reading matter is new, the illustrations are new, and the information therein will be new to almost everyone.

A copy of "Short Journeys on a Long Road" will be sent free to anyone who will enclose ten cents (to pay postage) to Geo. H. Heafford, General Passenger Agent Chicago, Milwaukee & St. Paul Railway, Chicago, Ill.

IN EFFECT MAY 19TH.

Remember the new service on the Nickel Plate road goes into effect May 19th. Afternoon train will leave Chicago at 1:30 p. m., arrive Cleveland 11:30 p. m., Buffalo 6 o'clock a. m.; evening train will leave Chicago at 9:20 p. m., arrive Cleveland 9:50 a. m., affording business men an excellent train service to those cities. Through trains between Chicago, New York and Boston, without change. Superb dining cars. City ticket office, 111 Adams street; telephone main 389.

HOMESEEKERS' EXCURSION TO UTAH ON JUNE 11TH AND JULY 5TH, 6TH AND 7TH.

On June 11th all lines from Chicago, St. Louis, St. Paul and points west thereof, will sell homeseekers excursion tickets to Utah via Rio Grande Western Railway at rate of one single fare for the round trip. Tickets will also be on sale July 5th to 7th inclusive, on account of educational meeting, but homeseekers can take advantage of the low rate to investigate the resources of Utah, the coming State. It is expected that Utah will enter the Union of States before the close of 1895 with a population of 250,000 souls, and the most magnificent and healthful climate in the world. Within its borders are found all the known precious metals. In agriculturul and pastoral resources it surpasses any other domain. Millions of cheap homes now awaiting settlement in this land of Utah, which can produce all the necessities and many of the luxuries of life. For printed matter address L. B. Eveland, 115 W. Eighth street, Kansas City, Mo., or F. A. Wadleigh, Salt Lake City.

CABLEWAYS.

THE following regarding traveling cableways which are largely used at the present time in the construction of irrigation and waterworks dams, is taken from a paper on "Cableways," presented before the American Society of Civil Engineers, by Spencer Miller, member Am. Soc. C. E., and engineer of the Lidgerwood Manufacturing Company, New York City. This company has been prominently identified with the development of the traveling cableway, and the description which follows of the Lidgerwood Cableway, and which is contained in Mr. Miller's paper, shows clearly the high state of simplicity and efficiency to which this important aid in the building of large masonry structures has been brought.

We quote, with some corrections to date:

"The cableway may be defined as a hoisting and conveying device employing a suspended cable as a trackway. Long span and high speed cableways were not practicable with the chain-connected fall-rope carriers. Fig. 1 shows the first departure there-

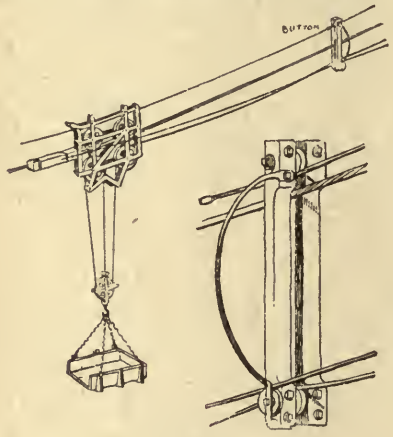


Fig. 1.
(Patented in 1890.)

from, and represents the beginning of a development which the author made in the line of improved fall-rope carriers, employed at Tilly Foster, N. Y., for uncovering an iron mine."

As will be observed, an auxiliary rope, about five-eighths of an inch in diameter, is suspended above the main cable, held in a parallel position to the main cable by passing under wheels in the cable carriage.

On this rope a series of buttons are secured, whose diameter increases with the distance from the head tower. Slots in the head of the carriers, corresponding to the diameter of the buttons, allow each of the carriers in passing down the incline to be stopped at its proper button. These carriers have small wheels to roll on the auxiliary or button rope. Thus, the heavy cumbersome chains are dispensed with, and these fall-rope carriers, spaced by buttons, answer all the requirements of chain-connected carriers, and weigh about one-tenth as much.

The development of a few years has brought the carriage and carriers up to a standard form, as shown in Fig. 2.

The cable carriage is usually built with two main cable wheels, but in some instances three wheels have been used. The various ropes are indicated in the illustration. The horn in front of the carriage picks up the carriers as it passes toward the engine and also carries them out as the carriage recedes; the buttons on the button rope take the carriers from the horn and leave them spaced along the main cable at proper intervals for supporting the hoisting-

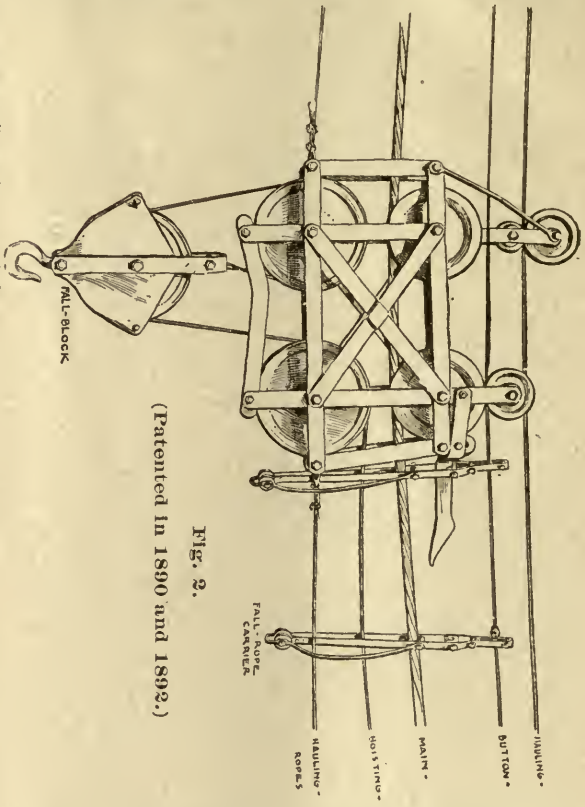


Fig. 2.
(Patented in 1890 and 1892.)

rope. These buttons increase in size, receding from the head tower, as also do the corresponding slots in the head or top of the carrier.

Fig. 3 illustrates an engine with double cylinders with cranks connected at an angle of 90°, and is fitted with reversible link motion. The drums are of large diameter, regular friction type, one to carry the hoisting rope, and the other is turned with a curved surface, as shown, and carries the endless rope. The endless rope is wrapped around the drum five or more times, enough to secure sufficient friction to keep it from slipping in the opposite direction to that in which the drum is turning, and the ends are passed over the sheave wheel on the towers and made fast to the front and rear wheels of the cable carriage.

The hoisting drum is independent of the other, and, being of the same diameter, winds at the same rate of speed, and keeps the load at the same height if so desired. This drum has a band brake, by means of which the load can be sustained. The reversing lever, friction and brake levers are all brought to a central position, so that the operator can work all of them in one position.

In Fig. 4 the method of leading the ropes on the long span horizontal cableway is shown. The end

less rope serves to hold the carriage in place while the hoist is being made. For horizontal motion the hoist rope is drawn in and the endless rope is paid out at the same rate of speed. As will be observed, the load may be hoisted or lowered at any point under the line of the cable, and the horizontal motion is given the load at any height to which it may be raised.

A cableway at Austin Dam 1,350 feet span handles loads up to eight tons.

A cableway used for building the Basin Creek dam in Butte, Montana, spanned both a quarry and dam, and stones were picked up from the quarry and delivered without rehandling.

The United States Corps of Engineers, under Lieutenant W. E. Craighill, used a cable for building the lock and dam on the Coosa river, near Lincoln, Ala. The plant was erected in the spring of 1891; span, 1,000 feet; main cable, two and a half inches; load, eight tons.

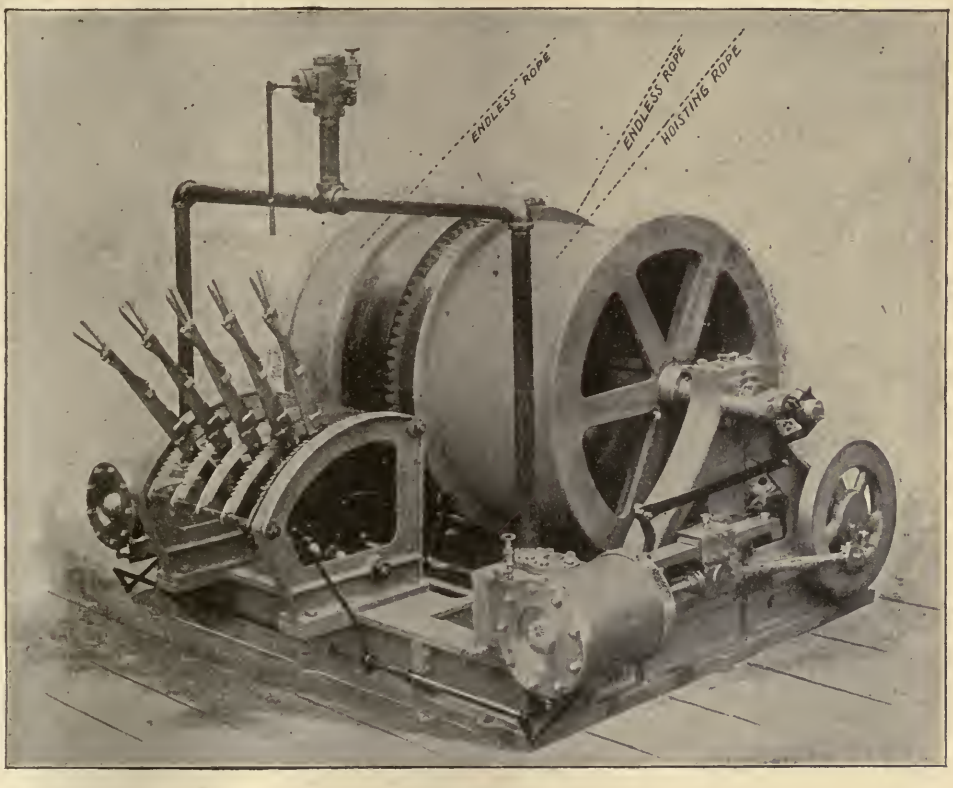


Fig. 3.

The heavy take-up device (Fig. 5) is not intended to be used in erecting the plant, but it is to take up the stretch occurring as the cable is used, or in raising the cable as the dam increases in height.

One great advantage of using a cableway lies in the employment of a shallow skip, which, as will be observed, is easily filled by hand, with no preliminary

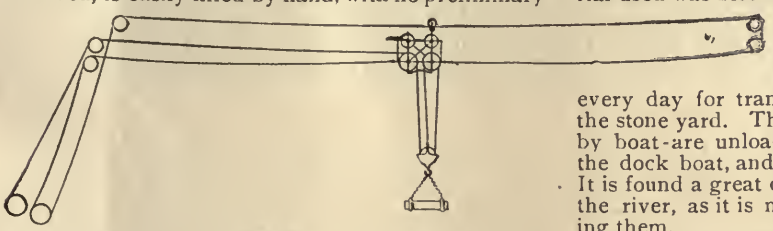


Fig. 4.

work after a blast. At least two tons per man per day more may be filled into a skip eighteen inches high than into a car thirty-six inches high.

The stone for this lock and dam was procured from a quarry about two miles back from the site of the dam; a three-foot gauge road was built and equipped with locomotives and cars. Each car held as its body, a skip which was picked off the car by the cableway, and by it delivered into place. The material used was brick and loose rock. At Point Pleasant, W. Va., is a Lidgerwood cableway, used for building lock and dam. One tower is 100 feet high. The cableway is used every day for transporting stone from the quarry to the stone yard. The supplies and materials arriving by boat are unloaded upon the coffer-dam or upon the dock boat, and brought ashore by the cableway. It is found a great convenience in taking men across the river, as it is much more expeditious than ferrying them.

This plant has the distinction of being the largest hoisting cableway in existence, the clear span being 1,505.5 feet; main cable, two and a half inches diameter; maximum net load handled, four tons. A

great deal of material is also brought in over a railroad siding on the other bank of the river. A seam of coal underlies the quarry, and an amount sufficient for all purposes is mined and transported directly by cableway to the dredges, hoisting engines and pumps in the river, as well as to the boiler and electric-light plant.

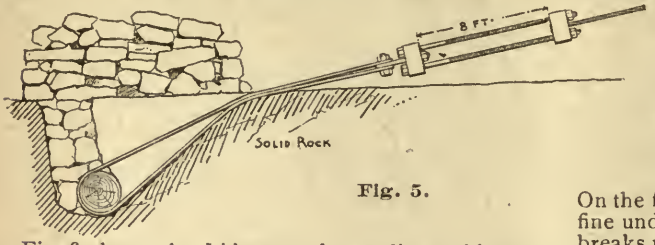


Fig. 5.

Fig. 6 shows the Lidgerwood traveling cableway, of which, at the present time, twenty are in use in the work at the Chicago Drainage canal.

way is used merely to take material from the canal and deposit it in spoil bank on one side. The work is usually done on a breast 12 feet high. The record shows that 32 men at the breast, filling skips and chaining large stones, average 14 cubic yards per man per day, or 28 tons of material. Of course, it would not exceed 11 yards if it were not for the fact that a great saving of time is accomplished by the handling of large stones out of the pit by simply chaining them to the fall block. Stones weighing six or seven tons have been handled out of the canal in two or three minutes, thereby making a distinct saving in cost for drilling, powder for blasting and the cost of sledging; and the mere act of throwing the chain around a heavy block is only a fraction of the cost of filling the skip. On the first twelve feet of the canal the stone broke up fine under the blast; on the second and third lifts it breaks up so large that the work seems to peculiarly fit the cableway, and a large saving is made on all material that is handled out in large blocks.



Fig. 6. Head Tower Lidgerwood Traveling Cableway.

The span of this cableway is 700 feet; the towers are 90 feet high, and are located on cars 102 feet long; each one of these cars rests on twenty-seven 33-inch wheels, and on this car or platform are located at the head tower the engine, boiler and the required amount of ballast, and on the tail tower simply sufficient amount of ballast for its stability.

The main cable is 2¼ inches; the engine is double 10x12, 50 horse power, with double drums. The cable-

In handling large stones the danger of slipping a chain or breaking a link is minimized on account of the fact that the stone may be handled horizontally at any height desired, just sufficient to clear the surface of the ground if required. The usual practice is to deliver these heavy blocks on the canal slope of the spoil bank, and they are frequently taken out at the noon hour, with only two or three men at work on extra time, so that when the men come in to fill the

skips they can find nothing but uniformly broken material to handle.

The aerial dump (Fig. 7) has recently been developed which has increased the capacity of the cableway enormously.

The auxiliary rope arranged to draw up the bucket or skip is installed, passing from the carriage to the engine, parallel to the hoist rope, and winds on the same drum as the hoist rope. Therefore, when it is desired to dump the load it is merely required to draw in this rope at a little higher speed than the

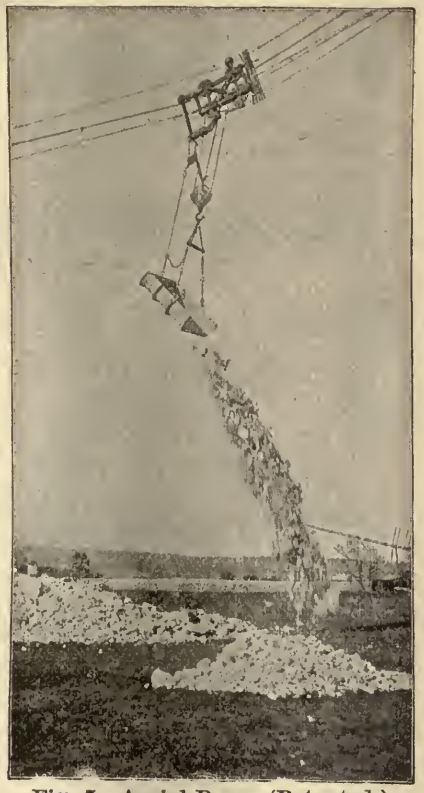


Fig. 7. Aerial Dump (Patented.)

hoist rope, thus the material delivers without delay to the cableway. The instant the load has been spilled from the skip the carriage returns to the canal. For obvious reasons, any authentic records are difficult to obtain, but the following are understood to be correct. The record for the month of October was 333 skips daily. The greatest day's run was 656 skip loads of broken stone, in 20 hours, making a total capacity of 1,312 yards, or 2,624 tons.

Blocks of stone weighing 20 tons may be handled with the cableway. The speed of the machine along its tracks will probably be from 25 to 50 feet a minute. The speed of the carriage upon the cable about 1,000 feet a minute, and the speed of hoisting from 300 to 400 feet a minute. It is more desirable than derricks in many ways. First, the legs and guys of the cableway are entirely out of the way of the work, hence no preparations need be made for making a blast, except it be the removing of the drills, etc., which is done quickly and easily by means of the cableway itself. Thus, not only is a saving made by virtue of the fact that nothing can be injured by the blast, but the blasting can be done more economically, because it can be unlimited in extent. Three or four thousand tons of material have been blown down underneath a cableway without the slightest damage to the apparatus. Again, the load after being hoisted can be conveyed to the car without any labor being required, as is necessary with derricks in the swinging of the boom.

The following irrigation and water companies have purchased Lidgerwood cableways for the construction of dams: South Gila Canal Company, 1,500 foot span; Aqua Fria Construction Company, 750 foot span; E. S. Babcock, of the Coronado Beach Company, three plants, about 1,000 foot span; Bear Valley Irrigation Company, two plants; and Butte City Water Company, 900 foot span.

WIND MILLS.

The Challenge Wind Mill and Feed Mill Company, of Batavia, Ills., of whose Dandy Steel Wind Mill we give a cut here, and whose ad. appears on another page of this issue, have been engaged in the manufacture of wind mills, feed mills and their appliances for the past twenty-seven years, and in all that time they have labored earnestly to produce the best article of its kind on the market.

The results are to be found embodied in their new Dandy wind mill, which is constructed wholly of steel and mounted on a steel tower. The whole construction is heavily galvanized in their own plant, which is one of the largest in operation in any country devoted solely to that purpose. This process, as applied by the Challenge people, obviates the necessity of painting for at least twenty years. All the bearings or wearing parts are composed of graphite, and the machines are therefore supposed to run for thirty years without oil.

As an evidence of this company's faith in their machines, they will send them to all responsible parties on a thirty days' test trial, and if not found entirely satisfactory they will remove them and pay the freight both ways. Their new steel towers are constructed of the strongest and best angle steel, and recent past experience demonstrates the fact that they will stand the most severe storms without even perceptible injury. In addition to the articles named this company also manufacture tanks, pumps, brass cylinders and a general line of water supply goods, together with the Challenge feed mills, horse powers, feed cutters, etc., etc., and if you are in need of any of these you should correspond with them at their home office.

GASOLINE ENGINES.

The Weber Gas and Gasoline Engine Company, of 426 S. W. Boulevard, Kansas City, Mo., have recently completed a new addition to their plant, the increased business of the company during the last six months having made this necessary. The offices will be removed from the second floor of the main building to the new building, and will be on the street floor. This will give about 3,000 square feet additional for light machine tools in the main building.

RECENT LEGAL DECISIONS.

Prescriptive Right to Use of Water in Stream.—In order to establish a right by prescription to the use of water for irrigation claimed by another, the use and enjoyment must have been uninterrupted, adverse and under a claim of right, and with the knowledge of the owner. This right becomes fixed only after five years' adverse enjoyment; and to have been adverse, it must have been asserted under claim of title, with knowledge and acquiescence of the person having the prior right and must have been uninterrupted. In order to constitute a right by prescription, there must have been such an invasion of the rights of the party against whom it is claimed that he would have ground of action against the intruder. To be adverse it must be accompanied by all the elements required to make out an adverse possession; the possession must be by actual occupation, open, notorious, and not clandestine; it must be hostile to the other's title; it must be held under claim of title, exclusive of any other, as one's own; it must be continuous and uninterrupted for a period of five years. The use must also be open and as of right, and also peaceable; for if there is any act done by other owners that operates as an interruption however slight, it prevents the acquisition of the right by such use.

Authers v. Bryant. (Supreme Court of Nevada.) 38 Pacific reporter. 440.

Irrigation.—The Supreme Court of Washington holds that the conveyance of an irrigation ditch, unconnected with the ditch from which the water is to be obtained to fill it, and without a sufficient fall in its construction to carry the water to the land intended to be irrigated, conveys no right to the water in that creek.

Wold v. May. 38 Pacific Reporter. 875.



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Standard Singers - $8.00, $11.00
$15.00, and 27 other styles. All attachments FREE. We pay freight ship anywhere on 30 days free trial, in any home without asking one cent in advance. Buy from factory. Save agents large profits. Over 100,000 in use. Catalogue and testimonials Free. Write at once. Address (in full), CASH BUYERS' UNION, 158-164 West Van Buren St., B 120, Chicago, Ill.

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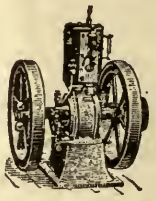
Wanted Good Writers

The newspapers and magazines want good news and miscellaneous writers. Schools and colleges demand good essay writers. Business men must have advertisements, catalogues and circulars prepared by good writers. I profess to be a good writer; my literary articles are published in the leading papers; I write essays and speeches for many college graduates; I give instructions to scores of young men and ladies who want to write for the press; my fees are moderate and my references the best.

JOEL SHOEMAKER, Journalist, Manti, Utah.

Reference: THE IRRIGATION AGE.

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THE IRRIGATION AGE.

VOL. VIII. CHICAGO, NOVEMBER, 1895. NO. 7.

CALIFORNIA FRUIT EXCHANGES.

THE COMMISSION SYSTEM COMPARED WITH THE EXCHANGES.

BY FRED L. ALLES.

THE principal difference between the commission system of handling fruits and the system of the California Fruit Exchanges is that the former is intended to benefit the fruit *dealers* and the latter is of benefit mainly to the fruit *growers*.

The commission system of handling California fruits has always been managed mainly for the benefit of the commission men. Naturally enough the men engaged in this business exercised their time and talents for their own benefit and not for the benefit of the public. This is the usual rule in all forms of commercial life and it would be folly to expect the commission men to be an exception to the general rule. Merchants engage in business usually to benefit their own private bank accounts, and not out of pure love for the dear people. So men have for years engaged in the business of selling California fruits on commission because there was profit in it for them.

EXTORTIONS OF COMMISSION MEN.

Little need be said here of the plans of the commission men, nor need details be given as to the manner of conducting the business, save in a brief way. The usual plan has been, and is to engage to pick, pack, ship and sell a crop of oranges, charging the grower from 35 to 50 cents per box for picking and packing and a commission of ten to twelve per cent on the gross proceeds for shipping and selling, returning to the grower the net returns if any. Of late years it had come to be quite frequently the case that the net proceeds were NIL—the division of the $2.00 received for the box of oranges being too often made at the decimal point, the commission company and the railroad company taking the dollar mark and the figure 2 while the grower got the two ciphers as his share. In fact there have been cases painfully frequent where the grower not only furnished the fruit but was called on in the end to pay a deficiency to meet freight charges and commissions.

Naturally, this state of affairs could not last long. The fruit growers would not have deemed these losses such a hardship if the consumers were getting the benefit, but they knew that the fruit was being sold in open market at a fair price and they knew also that the actual consumers of the fruit in eastern and northern cities were paying a good price for all the products of California orchards. And while freight charges were extraordinarily high when fruit shipments from the Pacific Coast were first begun competition in railroads and the great increase in the traffic have brought about reductions amounting now to about 60% of the original charges, in addition to increasing the transit time from the slow freight service of ten years ago to the fast passenger service of the present day.

The fruit growers of Southern California will rank high along side of shrewd business men anywhere in this country, and careful investigation and patient labor on their part finally convinced them that the germ of the trouble was the utter lack of system in the handling of their crops. They soon discovered that the commission men, in sharp competition with each other, were flooding certain markets with fruit while others were bare and when natural congestion followed the rushing of ten carloads of oranges into a five carload town, the commission men began to belabor one another, using the growers as clubs with which to beat their business rivals. This was undoubtedly fun for the commission men but was sure death to the unfortunate fruit grower.

THE EXCHANGE SYSTEM.

In starting in to change this lack of system the fruit growers did not indulge in the old and worn out cry of "away with the middle men." They realized the fact that the grower of fruits in California cannot deal directly with the customer in Illinois. They knew perfectly well that jobbers in the East were necessary to handle their crops in bulk and retailers were necessary to place the fruit directly

in the hands of the consumers. They made no attempt to open houses in the East for the sale of their product, either by the box or by the dozen. But they decided at one blow to wipe out the system which had grown up of hiring their packing and shipping done by men who had little or no capital at stake, who assumed no risks, and who were making small fortunes by handling capital which belonged to the producers themselves. They had no desire to wipe out the great fruit shipping firms and men who have done so much to build up the fruit trade of California by introducing it in the East and by popularizing it. Their fight was mainly against the small fry commission men whose main capital was honeyed words and whose principal coin was unkept promises.

Out of this absolute necessity the fruit exchanges of Southern California were born. It was absolutely necessary to change the system of marketing the crop or dig up the orange trees. The initial steps in the new organization were taken by a small band of Riverside gentlemen some three years ago, although nothing definite was accomplished the first year. The new movement naturally met with much opposition from the men whose business it aimed to do away with. The work of organization also was slow the first year, because the growers as a rule wanted to see the affair succeed before pledging their fruit to its care. There were naturally many jealousies of the men organizing the movement, their motives being misconstrued in some instances and often misrepresented by interested parties in others. But after a long struggle the system is finally in a fair way to become absolutely successful.

During the season of 1895 it has secured the support of more than one thousand orange growers in the five counties of Southern California and shipped to market more than one-half of the total output of 8,000 carloads of the crop of 1895. If in two years this new organization has secured control of one-half of the orange crop of California it is an exceedingly simple problem in arithmetic to determine how long it will be before it will absolutely control every box of oranges grown in the Golden State.

The numerous carloads of oranges handled by the fruit Exchanges were sold on the Eastern markets for about three millions of dollars. Of this a little over one million was paid to the railroad companies for freight, about one-half million was consumed in expenses of picking and packing and about one and one-half millions was divided up among its one thousand members, an average of about $1,500 each.

In no one thing has the Exchange System shown its value more pointedly than in the cost of packing and marketing the fruit. It has reduced the cost of packing from the old commission system average of 43 cents per box to a present rate of 28 cents, a saving to the growers of nearly $200,000 in packing alone. The Exchange charges the growers only actual cost for handling and selling the fruit, which this year has been about 4%, which is in sharp contrast to the old time commission system charge of ten per cent, a saving of a full $150,000 this year to the growers.

But the one thing which ground most heavily into the tender flesh of the California fruit producer was that he not only paid heavy transportation charges to get his fruit to market but he was compelled to pay the commission men a full ten to twelve per cent commission on this freight rate besides. For the dealer, in handling the crop for his California customer charged him a commission on the gross price at which the box of oranges sold in market. If the sale was at $2.00 the charge against the producer was itemized thus:

Picking and packing	$.43
Freight	1.00
Cartage and Warehouse	.10
Commission	.24
Total Charges	$1.77

And the grower got a balance of 23 cents per box, sometimes less, occasionally more. Thus his freight rate was not only the $1.00 which the railroad company charged for hauling but 12 cents were added by the commission man for a percentage on the freight rate.

EXCHANGE ORGANIZATION.

The Southern California Fruit Exchange is the central organization or Executive Board representing eight county or sectional exchanges. These eight county exchanges are the central organizations of some thirty local associations. These associations are not all organized on the same plan, nor are they all governed by precisely the same rules, although all are working to a common end—the benefit of the fruit producers of California.

The general plan is that all the growers in one locality or settlement desirous of joining the Exchange shall form an association selecting a local name for it and electing a Board of Directors and a Manager. Each Association Manager is a member ex-officio of what is known as the County Exchange. This County Exchange is incorporated under the State law and the members of all the local associations being members and stockholders and having a vote in accordance with their orange acreage. These Exchange officers control the output of their several associations, suggesting points to which shipments shall be made and as a corporation, guaranteeing the contents of every box of fruit bearing their individual Exchange brand. These County Exchanges are in turn controlled by what is known as the Southern California Fruit Exchange, which is really an Executive Committee composed of eight members, one selected by each county or sectional exchange. In this central body is vested the power of directing shipments and fixing prices. This central organization has an office in Los Angeles and is in daily telegraphic communication with every fruit market in the United States, and its shipments to the various markets are so regulated that only a reasonable supply of fruit is shipped to any market.

The original idea in organizing was only to pick and pack the freight, selling everything f. o. b., thus avoiding all responsibility for freight rates, damage to fruit en route and other losses incident to green fruit shipments. But this was soon found impracticable, as the commission men who were opposed to the system, still controlling nearly one-half of the total output of the State, constantly under-bid the Exchange on its own ground and sold on the Eastern markets at a lower rate. To meet this opposition the Exchange found it necessary to make Eastern shipments, sending a reliable agent to the central Eastern market, guaranteeing safe arrival of fruit and in every case warranting the fruit to be strictly as graded by the box marks.

Under the old-time system of indiscriminate shipments the Eastern dealer who ordered a carload of oranges by wire did not feel compelled to take them,

if he discovered two or three days after ordering them that he could buy a similar grade cheaper from some other shipper, and thus many carloads of prime fruit were rejected and a great loss fell on the shipper. But not only the shipper was a loser by this slack method of doing business, for frequently the dealer who thus tried to "do up" the shipper was himself "done up" in return. The orange grower having shipped the fruit to a certain market, possibly small and limited, finding after the fruit had started and was near its destination that the dealer who had ordered it would refuse to receive it on arrival, hastily wired some opposition dealer in the same place of the facts and probably offered him the fruit at a price much lower than that for which it was originally sold. This kind of an offer was usually accepted and this resulted in dumping two carloads of oranges on a market which one carload would ordinarily glut, and resulted in a loss to both the grower and the original purchaser.

Under the Exchange the system of rejections is entirely done away with. Any fruit dealer ordering a car of oranges from one of the exchanges and refusing to accept it on arrival, except for bad order, is promptly black-listed by the Central Exchange, and he can buy no more oranges from any Exchange or Association until he has set himself right by settling for the rejected fruit, and the strength of the Fruit Exchange is already so formidable, that no fruit dealer would now attempt an old time rejection unless he contemplated going out of business very soon thereafter.

The matter of price at which the fruit shall sell is fixed by the Central Exchange after a close study of the markets, the aim being to place the fruit on the market at the opening of the season at a low figure to stimulate demand, and then slowly advance the price as the quality of the fruit improves and the consumption grows stronger.

A grave error was committed by the managers of the Southern California Fruit Exchange last spring in sharply advancing prices as soon as the full effect of the freeze in Florida was announced. To advance prices in the face of a limited supply and an unlimited demand is the rule always in commercial circles and in doing so the managers of the Fruit Exchange merely showed their human nature, but it was a grave and costly error nevertheless; it created a prejudice in the minds of Eastern people against California fruit and California fruit growers, but the mistake of 1895 will not be repeated while the present management of the Fruit Exchange exists.

This much of the Exchange System as an organization.

THE METHODS OF HANDLING FRUIT.

The method of handling the fruit and the standing of the individual grower in the local associations has been a question difficult of satisfactory solution, but the following general plan has been adopted by nearly all the associations: All the fruit belonging to the members is pledged to and is under the absolute control of the managers of the local association. It is picked at such time and in such quantities as he determines, this being done by the grower himself, who delivers his fruit at the packing house in such quantities as are called for. It is weighed on delivery, is then carefully graded into "Fancy" "Choice" and "Standard" and is also assorted as to sizes. The damaged and over and under sized fruit is rejected as culls and is charged back to the grower. He gets credit on account for a certain number of boxes of each size and grade which he furnished for the carload or shipment, for which his fruit was picked. All boxes of his fruit are marked with his individual number and the car goes to the market directed by the Central Exchange. When the returns from that particular carload are in, all charges for selling, freight and packing are deducted and the balance is placed to the credit of the growers, who check against it at once, and so successful have these shipments been during the present season that nearly all banks doing business in orange growing centers have this year made ready and liberal advances on packing house receipts for fruit delivered, even before the oranges were packed ready for shipment.

Before closing what is at best only an outline of a system which has revolutionized the fruit industry of Southern California I desire to quote a few words from two gentlemen who are largely responsible for the success of this new movement.

Mr. A. H. Nafzger, of Los Angeles, President of the Southern California Fruit Exchanges, said in an address delivered in March last:

"We are not organized as a trust for the cornering of markets, saying that we have all the oranges on earth. We are not organized for war on the commission men or any one else. We are organized first, for the purpose of selling the goods f. o. b. in California.

"It is our belief that there is no warehouse or store house or any other receptacle for oranges or other products of California but California itself. The old method of loading the fruit on the cars and sending it 2000 miles away and putting it in the hands of men we never saw and who have no interest in us whatever, we want to do away with entirely. So that whatever the goods may be worth it is not for us to say that the goods shall not be sold unless they bring $3 or $5 a box but it is for us to say that the goods shall be placed on the market at the lowest possible cost and sold in the market at what the market can afford to pay—that is our undertaking.

"We have decided so far as the orange growers of Southern California are concerned, that it is not necessary to hire somebody to place our goods on the Eastern market as we have been doing. Now can we do the business.

"We have found that the same business conditions affect this business that affect any other business. We have found that the same careful and economical methods are factors in this business to make it profitable that will make any other business profitable.

"We have concluded that if the orange growers of Southern California have not sense enough to transact their business, not only the care of the fruit, but to market it, they had better sell their ranches to men who have sense enough to do so."

To T. H. B. Chamblin, of Riverside, is due the largest part of the credit for the organization of the Southern California Fruit Exchanges. In reviewing the first year's work of the organization, and attempting to interest new growers in the movement he said in a public address:

"The Orange Exchange movement at that time was more or less theoretical in character. It made no promise but sought to get the growers solidly into line upon a co-operative basis, in the hope to so regulate shipments and prices as to extricate the industry out of the slough of despond and place it on a paying basis. It promised a measure of success

and the facts now demonstrate that it has accomplished what its promulgators and champions had hoped for. When we allow for the strong opposition to the movement, the distrust and apprehension of its being able to carry on the business of shipping and marketing the fruit—a distrust be it said, not confined to dealers and shippers but also including many growers themselves—this success is all the more gratifying and pronounced. The Exchange entered upon a demoralized and degraded market, when all producers of citrus fruits were discouraged and disheartened. The trade at the other end of the line was also in a condition of chaos and fought shy of the new movement. In addition to this, misfortune by the elements was added to those of a depressed market, a per cent of the crop was more or less injured by the frost. To these obstacles must be added the hostility of the brokers and merchants—not all, but a large number—to overthrow the organization and again secure control of the business. In the face of these contingencies and reverses the success of the Orange Growers Exchange in Southern California stands without a parallel in the history of co-operative fruit marketing on the coast or in the United States."

This paper is confined entirely to a review of the method of placing Southern California oranges on the market. An attempt has been made to organize the deciduous fruit growers of Southern California along these same lines, but it has thus far been unsuccessful. The deciduous fruit business of Southern California is in its infancy as yet and is small in proportion to the citrus industry. When it assumes larger proportions those engaged in it will undoubtedly see the necessity of intelligent organization for self protection.



AN IRRIGATION DITCH IN WASHINGTON ON THE LINE OF THE GREAT NORTHERN RAILWAY.

NEBRASKA'S IRRIGATION DEVELOPMENT.

WATER SUPPLY—CLIMATIC CONDITIONS—STATE LEGISLATION.

By R. BEECHER HOWELL, C. E.

A LINE drawn in a southwesterly direction across the State of Nebraska from the northeast corner of Knox county to the southwest corner of Furnas county, traverses approximately the medial line of a belt receiving an average mean rainfall of about twenty-four inches per annum. To the east of this belt the precipitation is greater, while to the west it decreases in a regular ratio. The line above referred to may be accepted also as the line of demarkation between the humid and semi-humid portions of the State. The humid region of Nebraska, as thus defined, comprising about 32,000 square miles of territory, contains a million inhabitants, and is unexcelled in agricultural resources as compared with any other State in the Union. Its soil is fertile to a degree; every cereal and other product known to the temperate zone can be cultivated here with the assurance of a harvest as abundant and certain as that which befalls any other region of the world of the same latitude. If Nebraska only included its humid counties alone it would still be a great State, exceeding in area West Virginia, Maine or South Carolina; it would contain four times as many square miles as the state of Massachusetts, and its extent would be but one-fifth less than that of Ohio, Tennessee, Virginia, or of all the New England States combined.

THE SEMI-ARID PORTION.

But Nebraska is all this and more. To the west of the line above mentioned are 44,000 square miles of magnificent prairie lands, carpeted with grasses that render this section one of the finest stock ranges of the great West. With the exception of about 15,000 square miles, which compose the sand hill areas of this part of the State, the fertility of the soil is as great as that of the lands just west of the Missouri river, and in years of plentiful rainfall the crops produced in this region have been the envy of the farmers of the humid section of the State. While the climate of this portion of Nebraska is delightful, the rainfall is uncertain, and for this reason the settlement of the buffalo grassed table lands lying between the Platte and the Republican rivers has been the source of disappointment and misfortune to those who were lured thither by the smiling prospects of the dark green prairies in June. But experience alone is the great teacher of the limitations and possibilities of development in the unpopulated regions of the new world, and so it came that a hundred and fifty thousand people found themselves located in the semi-humid portion of Nebraska before it became notoriously evident that the uncertainty of rainfall in that part of the State renders agriculture, as a pursuit, uncertain and hence unremunerative.

Whatever may have been the former hopes for Western Nebraska as a rain belt agricultural region they have all been dispelled by the short crops harvested since 1890, culminating in the total failure of last year. The people of the East have heard much of the suffering and misery due to the drought and hot winds of a year ago, and to those unacquainted with the situation it has been the impression that the misfortune was a general one throughout the State. While it is true that agriculture was far from remunerative, even in the eastern counties, during 1894, yet it is equally true that suffering and privation was confined almost if not wholly to the semi-humid region, as above defined. Eastern Nebraska is no more subject to droughts than Michigan, Ohio or Indiana, but in the western counties of the State it must be acknowledged that agriculture without the aid of irrigation is so uncertain in its returns as to render its pursuit, to say the least, undesirable. This conclusion was practically reached some five years ago, and since that time the progress of irrigation in the great valleys of the State has been remarkable indeed.

Nowhere in the semi-arid region is the altitude so favorable, the available water so abundant or the problem of reclamation so simple as in Western Nebraska. In considering locations, altitude is often lost sight of by the uninitiated, and yet, this is a factor that has a most important bearing upon the success of agriculture in the arid West. Those looking for irrigated lands, however, need have no misgivings upon this score so far as Nebraska is concerned, for so favorable is the elevation of even the high table lands in the extreme western portion of the State, that whenever sufficient moisture is present corn can be grown equal in quantity and quality to any produced in the vicinity of the Missouri river.

THE WATER SUPPLY.

Excluding the Platte river there are four watersheds from which water supplies can be obtained: those of the White, Niobrara, Loup and Republican rivers, affording in the aggregate several thousand cubic feet per second. The Platte river, which alone has its source in the mountains, is a peculiarly favorable stream for irrigation purposes. Not only does its flood season occur during the months of June and July when its discharge varies from 6,000 to 12,000 second feet, thus coinciding with the period of greatest use, but its declivity, like that of most western streams, is relatively great and its banks low. Here, as in the other valleys of the State, little or no rock that cannot be plowed, is met with in the construction of canals. The broad level bottom lands and benches afford especially advantageous opportunities for the use of graders in the removal of earth. As a consequence, earthwork is cheaply done and the cost of reclamation correspondingly low. When we add to these facts the additional fact that there is a population in the semi-humid region exceeding that of Montana, or that of Wyoming and Idaho combined, the causes responsible for the rapid advancement of the irrigation industry in the State are rendered apparent.

The first considerable canal was constructed in 1883 in Lincoln county in the vicinity of North Platte, yet little water was used therefrom until in 1889 and 1890. Since then, however, the use of water has rapidly increased and the number of canals so multiplied that in October of 1894 there were, according to the report of the State Commissioner of Labor, 689 miles of canal completed, covering in the neighborhood of

360,000 acres of land, or more than half as much as was under ditch in Utah in 1890, as stated in the National Census of that year. If we assume that the cost of reclamation averaged $3.00 per acre, then upon the basis of the figures above given, the recent activity in the irrigation industry of the State means an investment of more than $1,000,000 within a period of less than four years. When we consider the expenditure and the amount of land reclaimed, it is doubtful if this record has ever been equaled by any other State of the great West.

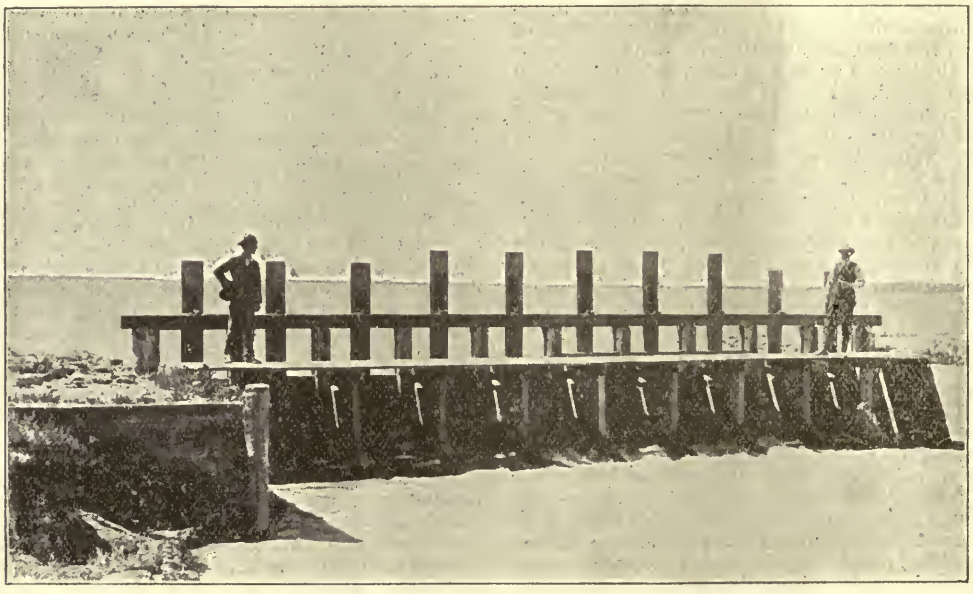
IRRIGATION LEGISLATION.

The first laws designed for the encouragement of irrigation development in Nebraska were enacted by the legislature of 1889, and though meager in detail and narrow in application, yet they were found sufficient to meet the demands of the situation. Under this statute the right to the use of water from streams exceeding fifty feet in width was secured by posting a notice of appropriation at the point of diversion and filing the same with the County Clerk. Hundreds of these notices are now on record in the various counties of the State, and one of the first duties devolving upon the present Board of Irrigation is the adjudication of the rights and priorities of the numerous claimants represented.

The inadequacy of the St. Raynor law—as this act was called—soon became apparent, and the two succeeding legislatures were applied to for relief. It remained, however, for the legislature of 1895 to fully recognize the importance of irrigation, and place it upon that sound foundation that was necessary for the continued development of the industry. As a result of the untiring efforts of Senator W. R. Akers, of Scotts Bluff county, two bills were passed, and an appropriation secured to render them effective. The first, known as the control bill, created a State Board of Irrigation consisting of the Governor, Attorney General and Commissioner of Public Lands and Buildings, with an administrative officer known as State Engineer and Secretary. An assistant secretary and two under-secretaries were also provided, with an additional provision for under-assistants in each of the water districts of the state that may be hereafter created. One of the first duties of this Board, as already stated, is the adjudication of the rights and priorities of the claims now on record. In addition thereto, the State Engineer is required to receive and pass upon applications for the appropriation of water and the construction of new ditches. And further, to supervise the division of the waters of the state among the various claimants in accordance with the Board's decrees.

The second bill was modeled after the "Wright" law of California, the provisions of which are so well known as to require no description here. The effect of this legislation is already apparent; a number of irrigation districts are now organized or in process of organization, and applications for water permits for seventy-six new canals were filed in the office of the State Engineer during the six weeks previous to the first of July.

In view of the results thus far achieved, and the flattering conditions under which further progress will be made, the friends of irrigation are fully justified in contemplating with complacence the future of that industry in Nebraska. Though, for lack of water, it may not be possible to eventually reclaim more than six or seven per cent of the 30,000,000 acres embraced within the semi-humid portion of the state, yet the intensive cultivation of this seemingly small area will place Nebraska in the front rank of the irrigation states, and in connection with the stock growing interests, assure the livelihood, contentment and happiness of half a million people west of the hundredth meridian.



HEADGATES OF THE BELMONT CANAL ON THE PLATTE RIVER IN NEBRASKA.

THE SANTA CLARA VALLEY.

UTILIZING THE UNDERFLOW TO IRRIGATE THE ORCHARDS.

BY G. F. ALLARDT, C. E.

A GREAT underground reservoir fed by Coyote creek is about to be tapped to supply water for irrigation in the Santa Clara valley, and also for use in San Jose. Nature has been lavish in her favors in the valley of Santa Clara, California. She has given it an unsurpassed climate; she has tempered the heat of the summer with cooling breezes; the soil is rich. The rainfall is of sufficient yearly volume to insure the bringing to maturity all varieties of deciduous trees; but they bear so heavily that while there is an average annual rainfall of fourteen inches this moisture is not enough.

In corroboration of this statement, I quote from several of the largest fruit-growers in the valley. Porter Bros. & Co. say:

"Answering an inquiry regarding our opinion of the proposed irrigating proposition for Santa Clara county, water to be supplied from wells located near Coyote station, it is our opinion that the proposition is one of extraordinary merit. That the fruit-growers of that section all need water will admit of no contradiction. We ourselves are subscribers for the water to cover eighty acres of prune land at $7 per acre."

Colonel Philo Hersey says:

"Nearly all of us, if not all of us, engaged in growing fruit and keeping up size and quality, as well as the growth and vigor of our trees, should provide means of winter and spring irrigation and also means for irrigation immediately after the fruit is harvested. I believe this would insure full crops more regularly, larger and better matured fruit, and relieve us of much anxiety as to injury of orchards from dry seasons."

C. M. Wooster says:

"I have no hesitancy in recommending the laying of pipe lines throughout the orchard districts of this valley for the purpose of supplying water for winter irrigation. I say winter irrigation simply because I believe that is the best for the orchards and best for the quality of fruit, and not by reason of implying that the water will not be available during all seasons of the year. It is well known that there is a vast quantity of water running under the ground at Coyote, and it is ridiculous for us to let that water run to waste when it is so much needed by our orchardists. Those who have established pumping plants have met with pronounced success."

J. L. Mosher says:

"As good roads and a near market are of value to land, available water is even more so. The three fundamental principles of successful fruit-raising are irrigation, cultivation and fertilization. Irrigation and cultivation is fertilization to a very large extent. My opinion is that the great drawback to fruit-raising in California is the long, dry seasons, causing a large amount of fruit to ripen before it is fully grown and matured by the lack of moisture. This is fully demonstrated by the comparison of orchards that are properly irrigated—the large and vigorous growth of trees, size and quality of fruit—the better price and wealth it has brought its owner. Orchards that are irrigated and put on a thrifty and vigorous growth are much less susceptible to insect pests or disease. Am anxious for the success of this water project, as I believe the section that it covers will become the garden spot of the State."

Various irrigating projects have been made from time to time to cure this one defect. Though it was generally known that some twelve miles south of San Jose there is stored underground a vast quantity of water covering an area of more than 7,000 acres of water-bearing gravel, and lying 250 feet above the level of the sea, no active steps toward its utilization had been taken until recently, when several enterprising capitalists took hold of the matter. They employed experienced engineers to look into the project and report upon the practicability of furnishing water to the Santa Clara valley. They have been at work for over a year and their researches reveal a condition hard to believe, if it were not backed by indubitable facts and figures. Based upon the reports of such engineers as Col. Geo. H. Mendell, G. F. Allardt and Aug. J. Bowie, a company has been formed styling itself the "Citizens' Water Company of Santa Clara County," which has purchased about 750 acres of land in the Coyote valley, and besides this controls the water rights of 3,500 acres additional, and proposes to furnish water at a moderate cost to all who need it. Colonel Mendell says of this underground reservoir:

"Coyote creek, emerging from the mountains, flows for seven or eight miles in a plain of its own creation, underlaid by permeable material, consisting of bowlders, gravel and sand. The bed of the creek forms the eastern line of the gravel-bed and is the highest part of the plain. The slope of the creek is less than the slope of the land. The cross-sections of the gravel-bed indicate the same condition of form in the underlying gravel, sloping more rapidly to the west than to the gorge. The voids in this bed of gravel are estimated to provide a storage for water of twenty thousand million gallons, equal to fifty-four million gallons per day, or 83 cubic feet per second, for 365 days. This covered reservoir was full in April last. It is nearly full now (August)."

"How is it filled and how and to what extent is it emptied under natural conditions now existing?" was asked.

"Coyote creek runs for the whole length of this plain, along its longest line, in a permeable bed, which connects with and forms a part of the gravel plain," said the Colonel. "At every point of the creek-bed the flow is solicited by steeper slopes and empty voids to leave the creek and to flow to the reservoir space waiting to receive it. The gaugings of the flow of the creek in moderate stages show that more than half the flow disappears between the canyon and Coyote station; and at this time the flow amounting to perhaps ten million gallons per day, entirely disappears within two or three miles after leaving the canyon, the lower creek-bed near Coyote station being entirely dry. Whenever the flow of the

creek is of sufficient volume this reservoir must be filled. This condition is now doubtless fulfilled, and more than fulfilled, in each average year of rainfall.

"In years of large rainfall the runoff would be two or three times as much as the reservoir capacity, while in a year of say six and one half inches of rainfall the contribution to the reservoir must be small. With the invisible escape at the gorge prevented, and but for the occurrence of the occasional drought year, there would be in each April 20,000,000,000 gallons of water available for the next year, equal to 54,000,000 gallons of water daily, being three times the amount of water furnished to San Francisco daily. But in order to maintain an even delivery in every year it would be necessary to leave in the reservoir in the spring water enough for thirteen months—namely, from the spring of one year to the autumn of the next year, including two summers. This would limit the yearly draft upon the reservoir to something between 10,000,000,000 and 7,000,000,000 gallons, or an average of 23,000,000 gallons for each of the twenty-four hours."

The gorge here referred to is at the lower end of the gravel deposits where the hills converge toward the creek. At some future day the company intends to sink a bed-rock dam across the gorge to prevent this invisible escape of the stored waters. For the present, however, the company will construct an infiltration gallery along the right bank of Coyote creek, just above the gorge and about 7,400 feet in length. It will be an open cut, ten feet wide on the bottom with slopes of one to one. At its upper end the grade of the bottom will be 16 feet below the level of the ground-water in the gravel stratum at its lowest stage. From comparisons made with similar galleries in the East and in Europe it is estimated that the daily yield in the dry season will reach twenty-five million gallons. During the rainy season the yield will, of course, be indefinitely augmented.

From the gallery the water will be carried along the foot-hills in a ditch about eight miles in length, where the hills merge into the valley. Thence the water will be conducted in plate-iron pipes to all points in the valley where irrigation will be required.

The elevation of the gallery above sea-level is 225 feet, while the average elevation of the main valley is less than 120 feet, thus furnishing ample pressure in the distributing pipes to flow the water by gravitation to all desired localities. Eventually it is proposed to bring a portion of the water, say four or five million gallons per day, to the City of San Jose, the present supply being quite inadequate, and in the dry season of objectionable quality. The elevation of that city being only about 90 feet above tide, this supply would likewise be furnished by gravitation, all pumping being dispensed with.

Contracts have been made with a large number of orchards for a term of thirty years. The company agrees to furnish 163,000 gallons per acre for the season, which is equivalent to a rainfall of six inches, at seven dollars per acre per annum. The work on the gallery is now under way and it is expected that the works will be in condition to supply the orchards early in the coming spring. The writer has been selected as the Chief Engineer and Col. E. G. Wheeler as General Manager. The aggregate cost of the complete works has been estimated at about a half million dollars. As the work progresses, or as soon as definite results as to the yield are obtained, I shall be pleased to communicate them to your valuable magazine.

MEASUREMENT AND DUTY OF WATER.

By A. M. RYON, E. M.

IT is a matter of considerable importance to know just how much water a given tract of land will require, and statistics on this subject are eagerly sought for by irrigation canal projectors, as well as by the consumers, who pay so much per year for a given quantity of water.

The amount of irrigation which a given amount of water will accomplish determines the duty of water.

We express the duty of water by stating the total depth of water applied to a given tract during the season; or by stating the number of acres which a constant flow of a given quantity of water will irrigate. A flow of one cubic foot (7.48 gallons) of water per second will very nearly cover two acres of ground to a depth of one foot in a day of twenty-four hours. As ordinarily expressed we would say that two acres of ground covered with water one foot in depth would require a second foot of water flowing twenty-four hours, or one-half a second foot flowing forty-eight hours.

We find a great variation in the reported duties from different sections, ranging from 2,000 acres for a flow of one cubic foot a second (about forty Montana statutory inches) to a depth of 200 feet per year.

In the United States the usual answer to an inquiry concerning the amount of water used for irrigation per acre is that one inch is required.

Notwithstanding these reports it is well understood that the amount of water actually needed varies with many conditions, including the nature of the crop, method of irrigation, character of the soil and subsoil, amount of rainfall, slope of the ground, climate, skill of the irrigator and the number of previous irrigations.

As all the irrigating is not done at precisely the same time, it is important to know how much water will be required for a given district during the irrigating season. It is quite possible that the rate of flow of a stream may be insufficient, providing all irrigators drawing water from it attempt to irrigate at the same time, and yet be ample where rotation is practiced. Our system of prior rights regulates this

to a certain extent, but not altogether satisfactorily. Ignorance or carelessness on the part of prior holders may result in working gross injustice by causing the waste of water which would otherwise be used by subsequent appropriators.

The rate of flow (expressed in inches or otherwise) does not afford sufficient data for us to compute the duty of water. We should know the length and frequency of the periods during which this flow is maintained.

No one would think of irrigating an acre with one inch of water, for it could not be spread over the ground; fifty inches would be ample, yet it would be used only about one-fiftieth of the time required for fifty acres. In many cases fifty inches would be sufficient for 100 acres, yet it would have to be used for a longer period; by this time, in some localities, it may be necessary to commence another irrigation. This would determine one-half inch per acre during the irrigating season as the flow necessary in that portion of the country.

THE MEASUREMENT OF WATER.

In the arid region there are approximately 5,600 square miles of irrigated area, or about one-half of one per cent of the total area of the lands within the States and Territories of the United States where irrigation is commonly practiced.* Of the remaining land, amounting to about 1,400,000 square miles, 1,062,000 square miles, approximately, is classed as desert and pasture land. The proportion of this enormous tract which can be irrigated will depend to a great extent upon the thoroughness with which we utilize our water supply. Careless measurement frequently results in waste and injustice.

The method of measuring water in Montana authorized by law is given as follows:

EXTRACT FROM COMPILED STATUTES OF MONTANA.

"Section 1262. The measurement of water appropriated under this chapter shall be conducted in the following manner: A box or flume shall be constructed with a headgate placed so as to leave an opening of six inches between the bottom of the box or flume and the lower edge of the head-gate, with a slide to enter at one side, and of sufficient width to close the opening left by the head-gate, by means of which the dimensions of the opening are to be adjusted. The box or flume shall be placed level, and so arranged that the stream in passing through the aperture is not obstructed by backwater, or an eddy below the gate; but before entering the opening to be measured the stream shall be brought to an eddy, and shall stand three inches on the head-gate and above the opening. The number of square inches contained in the opening shall be the measure of inches of water."

The Montana Society of Civil Engineers, recognizing the ambiguity and imperfection of this statute, endeavored to have it repealed and another law substituted which would establish a definite quantity of water flowing past a point in a given time as the standard. They proposed that a cubic foot (7.48 gallons) of water flowing in one second of time be taken as the standard, and that where water rights had been decreed by the courts, forty statutory inches should be considered equivalent to one cubic foot per second; that is a stream flowing forty statutory inches would fill a vessel of one cubic foot capacity in one second of time.

* Report on Agriculture by Irrigation, F. H. Newell.

The objections urged by the engineers against the present statute are:

1. It is ambiguous and no accepted definition of the word eddy will apply and make sense.

2. The velocity of the approaching water may be varied. If the head or height of the surface of the water be measured directly over the opening and a box or flume be used, there must be a certain velocity of approach, even if one end of the box or flume tap a lake. This velocity may be altered by altering the width of the box or flume in comparison with the width of the opening through which the water flows. For example, if we have an opening through which 100 statutory inches are flowing (6 in. × 16⅔ in.) with a box or flume of the same width, a very usual condition, we would have the area of the approaching stream (6 in. + 3 in.) × 16⅔ in. = 150 square inches; 100 statutory inches are equal to about 2½ cubic feet per second, so that the water would approach the opening with a velocity of about 2.4 feet per second. The theoretical value of the extra head due to this velocity would be something over one inch, making the actual head over the center of the opening something over 7 inches instead of 6 inches as apparently contemplated by the law. This would increase the flow about 6.4 per cent. This amount may be increased by bringing the water to the box with an initial velocity greater than 2.4 feet per second, or may be decreased by widening the box.

3. All measurements of head taken directly over the opening must necessarily be approximations; this may be a matter of little or no importance for small openings, but as the difficulty in securing accurate measurements increases with the size of the opening there eventually comes a limit beyond which it is practically impossible to measure water by the statutory inch-box with any pretension to accuracy. On an opening of 42 inches wide the surface of the water over the middle of the opening is depressed about ½ inch below the surface at the end of the opening.

The proper place to measure the head or height of the surface of the water above the opening is several feet up stream from the opening, but the statute does not provide for this.

4. The statute does not provide for the measurement of large bodies of water. A stream carrying 6,000 inches of water would under the statute require a box 1,000 inches or about 84 feet wide.

5. The Montana statutory inch does not represent any particular quantity of water, but a quantity increasing with the number of inches flowing. For instance, where the flow is 36 statutory inches, one inch is equivalent to about 15,108 gallons; but where 180 statutory inches are flowing, one inch is equivalent to about 15,964 gallons.

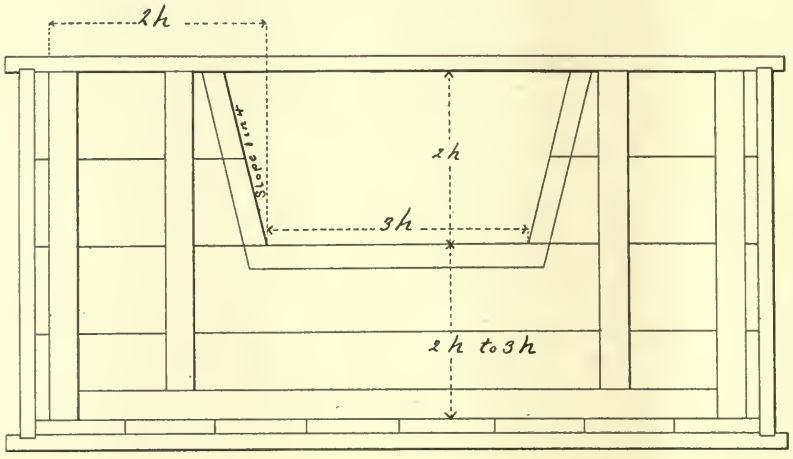
WEIR MEASUREMENTS.

No device for measuring flowing water has been more thoroughly tested and experimented with than the weir, with the result that notwithstanding the simplicity of its construction we may, by taking proper precautions, determine the amount of water flowing over it within one per cent.

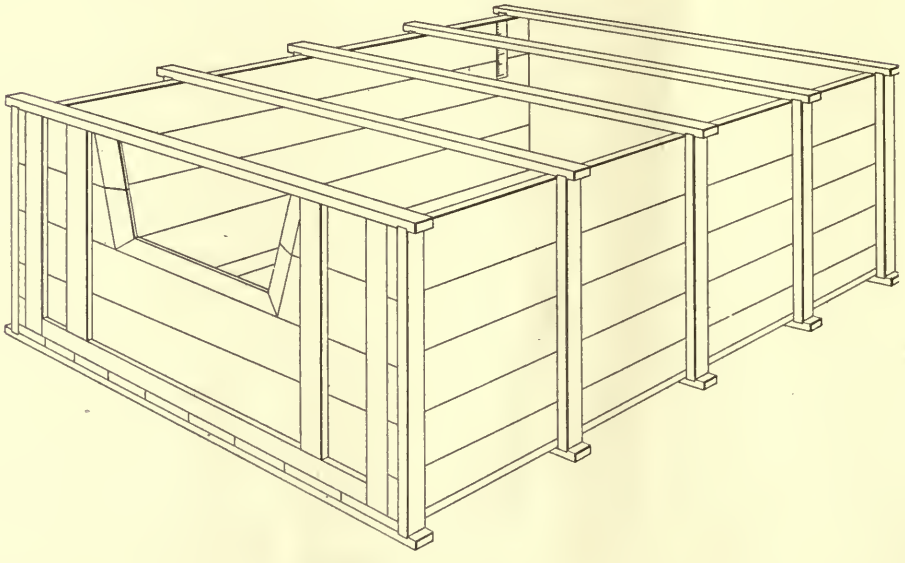
An idea of a measuring weir may be obtained from the accompanying engraving of the Cippoletti weir. The opening in this case is trapezoidal in shape, although a rectangular-shaped opening has been perhaps more frequently used. Where very accurate measurements are desired, the edges of the opening are made of comparatively thin metal. The amount of water passing through the opening is determined

THE CIPPOLETTI WEIR
FOR THE
MEASUREMENT OF WATER.

- the height of the surface of the water over the crest.



ELEVATION.



PERSPECTIVE

by considering the length of the weir and the height of the surface of the water over the horizontal edge or crest of the weir as it is usually called.

In flowing through the opening the stream is contracted by reason of the water passing around the edges, so that the area of its cross section is smaller than the area of the opening. With a given opening if we widen and deepen the box to certain limits we increase the contraction; beyond these limits no further contraction is observed. The contraction is then said to be complete, otherwise it is said to be partial. Where the bottom and sides of the box coincide with the edges of the weir the contraction is said to be suppressed. The suppression may also be accomplished in other ways. For convenience a weir with complete or nearly complete contraction is usually used.

Messrs. Flinn and Dyer of the Worcester Polytechnic school, under the direction of Mr. Clemens Herschel, a prominent hydraulic engineer of New York City, undertook a series of careful experiments at Holyoke, Mass., to test the accuracy of the Cippoletti weir. Their experiments showed that an error of but slightly over ½ per cent. might be looked for, providing proper precautions are taken.* The use of this weir simplifies the formula used by Francis, so that the discharge may be expressed as follows: $Q = 3.3\frac{2}{3}\ 1\ h^{\frac{3}{2}}$ in which Q = the discharge in cubic feet per second; 1 = the length of the crest of the weir in feet; h = the head expressed in feet and measured several feet up stream from the crest.

ADVANTAGES OF THE WEIR.

The principal advantages of the weir are:

1. Cheapness.
2. Ease of construction.
3. Accuracy.
4. It gives the amount of water flowing in terms understood the world over.
5. It is not necessary to maintain a constant head in order to determine the amount of water passing.
6. A small loss of head (smaller than the Montana statutory inch).

The only drawback which can be urged against its use is that it requires those who cannot solve an algebraic formula to use a table. A very slight disadvantage to place against so many advantages.

PRECAUTIONS NECESSARY FOR ACCURATE RESULTS.

In order to obtain reliable results in measuring water by any method, certain precautions are necessary. Where water is measured with a weir the following conditions ought to be observed:

1. The approaching channel should be straight and of uniform cross section, in order to avoid eddies and cross currents, for a distance of not less than fifty feet before reaching the weir.

2. The formulas assume that the contraction of the escaping jet of water is complete. In order to obtain complete contraction, the weir opening should lie in a plane perpendicular to the direction of the stream; the edges should be sharp on the up-stream side and cut away on the down-stream side so as to reduce the thickness of the edge in contact with the water. To insure perfect contraction the distance from the crest of the weir to the bottom of the channel should be three times the depth of the water flowing over the crest; the crest should also be a distance from either side of the channel equal to twice the depth of water flowing over it. The length of the weir should be three times the depth of the water over the crest and the depth of water on the crest should not be less than three inches.

3. In order that the velocity of the approaching water may not be excessive, the channel should have an area of cross section of at least seven times the area of the weir opening.

4. Air should be allowed to circulate freely around the escaping body of water where it leaves the weir. The flow is not impeded by raising the surface of the water in the lower channel, providing it is not raised so far as to prevent free circulation of air entirely around the water issuing from the weir opening.

5. The height of the surface of the water over the weir should be measured at a point several feet up stream from the weir, so as to avoid the depression which occurs as the water approaches the opening.

The effect of decreasing the distance of the sides of the weir from the crest is to increase the discharge. Ordinarily if this distance is decreased to a distance equal to the depth of water over the crest, the increased discharge amounts to about one per cent.

A further decrease in the distance increases the discharge more rapidly. When the bottom of the channel is below the crest a distance equal to twice the depth of water on the crest, the increase flow ordinarily amounts to about one per cent.

Experimenters have not agreed entirely as to the proper allowance to be made as a correction for the velocity of the approaching water. In ordinary practice, if the approaching channel has an area of cross section not less than seven times the area of the weir opening, the error is not sufficient to be worthy of consideration.

* Trans. Am. Soc. Civil Engineers, July, 1894.

AUSTRALIAN COLONIES.

By W. CLAUDE WILSON.

SO far there have been no large irrigation enterprises actually carried out in New South Wales similar to those in the United States or even the neighboring colony of Victoria, nor have we any law under which they can be so constructed, the few cases in which any start has been made having had to get special acts of Parliament passed to authorize them. The want of any law which will allow the appropriation of water from our rivers and streams has been a great drawback to irrigation enterprise, and where improvements in the shape of dams or weirs across creeks, etc., have been constructed, they are always liable to be, and in some cases have been, destroyed by settlers lower down, and there is no redress. The irrigation has therefore been confined almost wholly to the raising of a little fodder for stock, lucerne in most cases being the crop raised, and to the watering of gardens round the various homesteads and

settlements, and while these areas when totalled reach figures which are surprising, there has so far been a lack of any systematic irrigation development.

ARTESIAN SUPPLY.

Most of our large works are carried on by the Government and amongst others we have a Water Conservation Department which has been in existence for some eight or nine years, but although several large schemes have been outlined and extensive surveys of the whole country made, none of these schemes have as yet been authorized. Another Government Department is that of Public Watering Places and Artesian Boring which has the supplying of water along the traveling stock routes of the country, either by conserving the natural rainfall in large excavated tanks up to 20,000 cubic yards capacity or by artesian bores or wells, and in view of the fact that more than two-thirds of the country is devoted wholly to pastoral purposes, it will be understood that this matter of stock-water supply is one of great importance. During the last few years the artesian boring, both by the government and by private pastoralists have been very successful, large supplies of first-class water having been struck over the greater part of the dry western districts, having an average annual rainfall of from ten to sixteen inches only. Trial cultivations of a few acres irrigated with the artesian water from the bores have been very successful, and the Government have now in hand the establishment of irrigation colonies around the bores which give the largest supplies. The first of these settlements at Pera Bore near Bourke, a town in the center of the dryest part of the colony and the present terminus of the Great Western Railway, has been cut up into twenty acre blocks and was thrown open on June 1, 1895, for occupation on nominal terms, and should the demand prove as great as expected, more land in the vicinity of other bores will be thrown open. A Government Experimental Farm is to be established at each settlement under experienced irrigationists and should prove of great assistance to the settlers, while from the large area over which this artesian water is now proved to exist it is expected that these settlements will largely help in settling people in comfort on the land.

THE DARLING RIVER.

Another new scheme in which the first step has been taken, is the locking of the Darling River, the longest river in Australia, flowing through the center of the dry country. This work is being carried out by the Water Conservation Department and a tender for the first of the locks has been accepted, surveys for others are being proceeded with, and it is hoped that in the course of a few years, by this system of locking, the river will be rendered available both for navigation and irrigation all the year round, giving both the means of producing and cheap water carriage for the produce to the seaboard. With the dry climate and fertile soil of our back country, by using the best scientific methods we expect in the course of a few years to be able to produce large quantities of fruit which preserved or dried will successfully compete with such products from other parts, while the large amount of fodder able to be grown will keep our stock from dying off in hundreds of thousands as they do now every few years or so in times of drought, and largely increase the stock carrying capacity of the country.

IRRIGATION IN SOUTHWEST TEXAS.

IN CONNECTION WITH THE REMOVAL OF THE ARANSAS PASS BAR.

By J. S. ATKINS.

THE State Irrigation Convention held in San Antonio last fall awakened the people of Texas for the first time to the fact that irrigation in this country would be one of the grandest things on earth. For with its assistance and the advantage we have over other places with our early and late seasons, we can flood the markets of the United States with fruits and vegetables long before and long after any other State in the Union can begin to do so. It was a common thing last spring to see, during the months of April and May, as many as 800 boxes of vegetables leaving this town, Portland, of a morning, and this so far without irrigation, and on a very limited acreage of land. What then will they do when they do have it? There are two irrigation plants in Live Oak county, the county northwest of this one, and another in course of construction. I know that last year they tried irrigating some corn ground, and on four acres so irrigated they raised 440 bushels of fine corn. To show the earliness and lateness of shipments from this point, I quote the following data taken from the Express Company's books here as follows:

Wax Beans, last shipment, December 26, 1894.
Tomatoes, last shipment, February 1, 1895.
English Peas, first shipment, April 3, 1895.
Wax Beans, first shipment, April 14, 1895.
Grapes, first shipment, June 25, 1895.

I would like to mention that these shipments were fully three weeks late, owing to a lack of rainfall. What more then is needed to convince people that this country, irrigated, can beat any other portion of the United States in earliness, lateness and amount of production? People often question the amount that can be realized from the sale of vegetables raised on an acre of ground, when they are told that $100 an acre is a common thing.

I can vouch for the following being the truth: A friend of mine raised and sold over $1,500 worth of vegetables from fifteen acres of land this spring, without irrigation. I leave it to your imagination what he would have sold if he had irrigated. When it is taken into consideration that two crops can be made on the same piece of ground in one year, you will readily see that my figures of $100 an acre are very reasonable.

THE NEXT CONVENTION.

The Irrigation Convention called for November 12, at San Antonio, together with the new laws we now have bearing on the subject, ought to arouse the enthusiasm of the people and also attract the attention of Eastern capitalists to the splendid opportunities awaiting them here. Immense storage basins which can be utilized to store the vast bodies of storm-water which now with every rain goes to waste in the sea, can be got on any of the following rivers: Nueces, Aransas, Chiltipin and San Antonio. These rivers drain an immense area of country and consequently vast quantities of water are now lost which applied to the land would make a veritable Garden of Eden out of this section.

A DEEP WATER HARBOR.

One thing that will attract a great deal of attention to this country is the fact that we have in Aransas Pass Harbor the best natural harbor on the Texas coast. For some years it has been impossible to use this harbor to any extent, owing to the bar at the entrance to the Pass. And the people here have diligently been trying to get some one with capital enough behind him to build jetties and remove the bar, which is at present keeping the shipping out. They have at last interested Messrs. Alexander Brown & Sons of Baltimore in the project, to the extent that they are furnishing the money to do the work, but not before they had the opinion of the best engineers in the United States, foremost among them being Professor Haupt of Philadelphia.

The work is being rapidly pushed forward, and already the increase of water is considerable as far as they have gone. The effect that the opening of this harbor will have on irrigation will be apparent when I tell you that the moment we get over twenty feet of water over the bar, several railroads will build there, and then from there to Mexico, passing through some of the best localities for the establishing of irrigation plants, and giving the gardener and fruit-grower greater facilities for getting his vegetables and fruits to the Northern markets. It would make this too long an article to enter into a more detailed description of the work at Aransas Pass; it is enough to say that heretofore legislation has been against the entrance of capital into Texas, but now the barriers are being removed, and soon I hope to see Eastern capitalists fellowing the lead of Messrs. Brown & Sons, and developing the vast resources of this great and splendid State.

PUBLIC OPINION AND THE IRRIGATION CONGRESS.

VIEWS OF SOME OF THE PROMINENT DELEGATES ON THE OUTLOOK FOR THE COMING YEAR.

THE Irrigation Congress just held at Albuquerque, speaking in an all-round way, was the best gathering the friends of irrigation ever held, always saving the Los Angeles meeting. It was an earnest body of earnest men. It was held in the land of sunshine where a scanty rainfall, even, is at a premium. The gathering was very pleasant and its local management was in most excellent hands. I came away thinking the hospitality of those people was certainly well nigh unbounded. Nothing was done by the halves. All arid America save five States was represented, besides a half-dozen of States east of the Missouri River. Two points were urged by myself in my annual address. First, a liberal appropriation to continue the irrigation survey; and second, the parceling off of arid America into natural irrigation districts to be done by State and Federal law, with the absolute control of the waters of such districts put into the hands of the farmers therein. It is also to be noted that the Press generally, gave this Congress much wider notice than has been the case in the past. Altogether I may say that the cause of irrigation is well abroad in the land after only two years of active work.

JUDGE J. S. EMERY, of Kansas.

THE International Irrigation Congress held at Albuquerque, New Mexico, last month, has given a new impetus to irrigation. As a result of this great international gathering of experts, the science of irrigation is much better understood. The poor and half-discouraged farmer on the plains has learned better methods, has received practical advice and encouragement, and is going forth with quadrupled energy and faith to retain the water that falls upon his farm, store a portion of the flood waters, bring some of the underflow to the surface, soak his ground this fall and again next spring and build up a home where he can live, independent and prosperous, on a small, but productive and unmortgaged farm. Efforts to farm in the old American desert, in a scientific manner, have met with phenomenal success. Reports show that 98 per cent. of all who have made a test of rational methods of irrigation and cultivation have been successful far beyond their most sanguine expectations. What other enterprise has made half as good a showing?

Until recently the great mass of people looked upon irrigation as an iridescent dream, and many ridiculed the idea that human agency could change natural conditions. The irrigation congresses however, have directed the attention of our people to the fact that in our country and in other countries, natural conditions have been even reversed by human agency. Their attention has also been called to the fact that for centuries millions of people have subsisted bountifully in regions far more arid than ours. These great national gatherings are arousing the people to realize the value of these fertile plains and are developing a public sentiment of sufficient force to induce Congress to promptly give the subject of irrigation its share of attention. In twenty years from now these now forsaken plains will be the most productive, healthful, and beautiful farming region on the globe, where the disadvantages of both city and country life will be eliminated, the

advantages of the two will be combined in one happy medium condition and the melody of "Home Sweet Home" will form one unbroken strain from the mouth of the Rio Grande River to the northern limit of our country. WM. REECE, of Nebraska.

EACH Irrigation Congress has served as an educator—a means of keeping the matter of the reclamation of the arid lands before the public and of extending knowledge and interest in this behalf. The Albuquerque meeting answered these purposes, though to a less extent than previous congresses have done. This was not because the public has less interest in the great problem of irrigation, for the country at large was never so ready as now to hear whatever may be said on the subject; but simply because there was not the same painstaking efforts to make the proceedings widely public which have characterized previous meetings. Steps were taken looking toward securing imporant national legislation and if the work is properly followed up and supported, good will be accomplished.

JUDGE J. W. GREGORY, of Kansas.

OUTSIDE of the immediate irrigated districts, the general public knew practically nothing about irrigation, until after the organization of the National Irrigation Congress. Now the subject commands, to a greater or less degree, the earnest attention of the people of the whole country. Increased interest has succeeded each meeting of the Congress heretofore, and I know of no reason why the one just held at Albuquerque should be an exception to the rule. The subject of irrigation deserves the serious and favorable consideration of statesmanship; the reclamation of the naturally rich lands of the arid and semi-arid regions is entitled to as great consideration as has heretofore been given to the perfection of the farm lands of other portions of the Union. But, after all, it is a matter of political power and influence, and it is one of the important missions of the Irrigation Congress to impress the Congress of the United States by the only argument to which that body is naturally disposed to give patient and respectful attention. Congress loves to listen to an argument which is emphasized by an army of earnest, determined, aggressive voters.

I am satisfied that E. R. Moses, our new Chairman, will do everything in his power to advance the cause, and, as is well known, his resources will enable him to do effective and satisfactory work.

J. V. ADMIRE, of Oklahoma.

THE Irrigation problem has passed beyond its initial stage, and must now, if it is to keep pace with the sentiment it has created, go on to its legitimate issue, *i. e.*: I. The adoption of the principle by the so-called "humid" States, in order that intensive agriculture and horticulture in those States be aided by the means thus presented.

II. The certainty that Federal control must dominate the waters of the United States, and incidentally that no portion of the public domain must pass beyond the immediate regulation of the same authority.

III. That any comparison between the crop returns of the "arid" regions, with water artificially applied, and those of the "humid" section, where reliance is placed solely upon rainfall, is entirely in favor of the former. The "arid" States have made a step in civilization which the "humid" States have as yet failed even to recognize.

IV. That no time must be lost in formulating legislation respecting the water supply in any and all of the States. Irrigation and power now going hand in hand, irrespective of "aridity" or "humidity" of any section of the country.

V. The necessity for an immediate and permanent commission, board, or whatever you please, which shall obtain, compile and publish all information relative to our condition as regards ability to improve *any portion* of our country by means of irrigation.

THOS. KNIGHT, of Missouri.



A CANAL IN NEBRASKA.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

Short, practical articles, notes of experience and observation, are invited from the readers of THE IRRIGATION AGE who are interested in the promotion of the idea of the small diversified farm, providing to the fullest economical extent all of the various articles of food, clothing, etc., required by the family.

SORGHUM CULTIVATION.

BY MARY BEST.

IN Barber County, on the red beds of Central Kansas, the soil is especially adapted to sorghum, and it may interest some readers of THE IRRIGATION AGE to know what has been achieved with this crop.

The bulk of cane the last five years has been grown for sugar mill here, but owing to loss of bounty from United States and State of Kansas, this promising industry has been totally crushed for the present, and the pity of it is that whilst so much work has been done and money expended, the Government does not keep faith and allow the work to go on and obtain results in sight. Apart from manufacture, there is, however, great value in sorghum as a good and reliable crop, in every year, in this district, extending over a wide area on every side. In 1890 I planted fifty acres in this cane, increasing acreage every year until in 1894 I had 1,200 acres; half of this was hauled to the sugar mill, balance cut up and fed to stock of all kinds. Six hundred steers have been fed entirely on this cane and have come through the winter in splendid shape.

Five years ago if sorghum yielded 10 to 12 per cent. sucrose it was considered rich; now it has to be 15 to 20 per cent. to be satisfactory. Experience teaches that the richer in sugar the better the feed, and it cures well in proportion to the pure and select seed used. Cattle do not like unripe cane as well as the mature sweet stalks; on the other hand it does not do to let it get over-ripe, dry and hard. In planting mixed seed the varieties differ so much that in time of maturing they do not ripen together, green ones ferment, over-ripe turn sour. Amber, Folgers, Colman and Collier are all the varieties needed, and in order named from early to late; the same order applies to quality and ability to stand drouth, though there is not much choice between the three last named.

This field has been planted the last five years in sorghum, giving an average of twelve tons per acre and twenty bushels of seed. The gleanings on twenty acres have kept over one hundred hogs, most of the winter. Second growth gave pasture for cattle and horses, and not once in the five years have we had a sick animal from eating this cane, although the cows, as cows will, have broken through the fences and gorged themselves on the stuff in all stages, on first and second growths, green and dry hay.

As green food our stock show no preference for cane over the non-saccharine kaffirs, etc., but in the winter and spring they will hunt through a stack or tear any old roof to pieces to find a stalk of sorghum.

In dry weather it is a patient plant, waiting day after day; the leaves will dry up and blow away, and yet when a good rain comes in the fall, the plant rises again, sends out new growth and seed heads and yields of its abundance.

Listing is much safer in a dry country; once cultivating with a sled, twice with a shovel implement, and your crop is in good shape, it repays well all labor put upon it. Seed fed along with stalk makes a splendid ration for cattle and hogs, and work horses do well without other grain. Chickens love sorghum seed and travel far to the barns after it. We plant three pounds per acre to cultivate, drill one bushel for fine hay, cut up and put in shocks or haul to feed lot and stack in good windrows. There are many opinions about sorghum, but those who have tried it longest like it best.

SUBSOIL PLOWING.

BY T. L. LYON, B. S. A.

THE ordinary methods of soil preparation and cultivation have during the past two years proved inadequate to bring the soil into a condition capable of retaining through a prolonged dry spell the moisture it received by precipitation. Experiments have shown that subsoil plowing, especially if done in the fall, and a thorough cultivation of the land during the growing season, will do much toward conserving the soil moisture, thus enabling the crops grown thereon to withstand a drought much better than those grown on land treated in the ordinary way.

The good results of subsoiling on the Nebraska Experiment Station farm have been marked. No experiment was planned for testing the effect of subsoil plowing, but on land that had previously been subsoiled for sugar beets, and this year planted to corn, the effect of subsoiling was so strongly marked as to attract the attention of all who saw it. The subsoil and surface plowed portions of land on which the corn is growing are in the same field on the east side of the farm. It is upland soil, with a gradual slope toward the east. In composition it is a fine loam with considerable organic matter. In the fall of 1891 a portion of this field was subsoil plowed for sugar beets, and this crop was raised the following year. It was not again subsoiled, but plowed in the same manner as was the remainder of the field. It is a very noteworthy fact that the position of this subsoiled land can now be determined almost to a row by the superiority of the corn growing on it. The stalks on the land not subsoiled are small, badly dried up, and have not made any grain, while those on the subsoiled land are of good size, having a fresh, green appearance, and will give a fair yield of grain. This, it must be remembered, is the effect in 1895 of subsoil plowing in the fall of 1891.

The accompanying cut is the reproduction of a photograph taken on the edge of the subsoiled land, with only one row of the corn on the surface-plowed land in sight. This subsoiled corn stands in the center of the corn-field, in which the soil is entirely the



A CORNFIELD ON SUBSOILED LAND.

same throughout, and which was prepared for this crop in the same way at the same time, and the same cultivation given to both. When the subsoiled land was planted to beets the other was in grass. A portion of the field that was subsoiled and planted to beets four years in succession did not have as good a stand of corn as on the surface-plowed land, but this can be traced to the exhaustion of the soil by four years' successive cropping with beets.

How to Pack Apples.—Country shippers and packers of apples should make it a point to pack their fruit honestly, says the *Trade Bulletin*, that is, to have the fruit run alike all through the barrel. Do not endeavor to cause deception by placing good, sound, large fruit on the top and bottom of the barrel, and fill in the middle with a lot of gnarly, wormy and decayed fruit. It does not pay. The deception is easily detected upon investigation, and merchants do not care to have fraud practiced upon them, neither do they care to practice it upon their customers.

Full regulation-sized barrels should be used. Take the barrel, one head out, nail the hoops, and break off the ends of the nails on the inside; place a layer or tier of apples, good and uniform size, smooth, bright, healthy, as closely as possible, stems downward, on the lower end, then fill up, a basket full at a time, throwing out small, wormy, gnarly and windfall apples, and shaking the barrel well after each deposit until it is full two inches above the rim; place the head squarely on the apples and with a screw or lever press force it into place and nail securely. Turn over the barrel and mark name of apple with red or black lead, or pencil. Bear in mind that to be shipped safely, fruit must be packed tight, to prevent rattling or bruising.

Many Eggs.—According to the census, the United States produced 457,000,000 dozens of eggs in 1879 and 817,000,000 dozens in 1889. These figures are probably under the mark. Add to this the value of the poultry raised, and it is not at all improbable that the annual income derived from poultry is nearly, if not quite as much as that derived from the wheat crop, or about $300,000,000. This immense sum, according to Secretary Morton, is only sufficient to give the wives of American farmers a little pin money.

Relate Your Experience.—Much valuable experience goes to waste every year because it is not reported to the agricultural press and thus made the property of all intelligent readers. Farming is by no means an exact science. Like medicine, it is the growth of centuries of experience and the experience of farmers under similar conditions, climates, soils and circumstances is worth far more than the experience of farmers not similarly circumstanced. Let us have an experience meeting every week from now on.

The Gum Disease.—This seems to be a cracking of the bark, and an exudation of the gum, which sooner or later affects the bark underneath and kills the tree. No remedy has yet been found for this, and the recommendation is to dig them out. One phase of the trouble is that the trees, thus affected are the most inveterate fruit bearers. When a tree has borne no fruit for several seasons, it can usually be forced to throw its strength into fruit formation by checking its growth by pruning the roots, etc.

Saltpeter in Cornstalks.—The fine white crystals which are sometimes seen in the butts of cornstalks grown on rich land have been found to be nitrate of potassium or saltpeter. For a number of years a few Kansas cattle have mysteriously died from apparent poison. Dr. W. S. Mayo, of the State Experiment station, investigated some of the cases, and found that there was so much natural saltpeter that the cattle were poisoned by it. In one case green fodder grown upon an old hog yard was fed. The butts were so full of the crystals that they would burn like a fuse. In another case the dried fodder from an old cattle corral proved fatal. In a third case the stalks were grown on the ordinarily rich prairie soil. It would be well to examine all corn fodder for the white saltpeter crystals, and test some with a lighted match in a safe place. The leaves do little or no harm, but the cattle get the saltpeter by eating the stalks clean.

Humane Dehorning.—Not only humanity but good financial policy demands that dehorning be done with as little pain to the animals as possible. The evidence is conclusive that if the work is properly done and proper attention is given to the animals afterward, that they experience little pain or inconvenience, not missing a feed, nor does the milk-flow of cows perceptibly diminish. On the other hand, quite a number of cattle die from the effects of cruel methods and after neglect. No one should attempt to dehorn animals until he has assisted some one that does the work properly, and he should be careful to provide himself with the proper tools and appliances.

Root Knots.—This disease of orchard trees is one causing much concern in California. The knots are about the size of a hen's egg, and are found on the roots of prune, apricot, almond and peach trees. The Experiment Stations of the University, at Berkeley, the Stanford University, and Cornell University are working on the matter, but none of the scientists are able to say whether the disease is the result of fungus or insects. One remedy recommended is to cut the knot off with a knife and apply common salt to the cut.

Floriculture in California.—The late well-known and eminent horticulturist and seedman, Peter Henderson, said: "I am certain that California before fifty years will be the great seed and bulb-growing country of the world. You have the exact conditions of climate necessary to grow seeds, and I would advise you to at once begin systematically." Quite a business in this line is being worked up round Santa Barbara. There is scarcely a branch of floriculture that a live, intelligent woman with a love for the work could not succeed in, provided she has the pluck and determination.

Digestive Apparatus of Fowls.—Fowls swallow their food, broken or not, and it enters the crop or first stomach and remains in it until it has become softened more or less, when a small quantity at a time, just as grain runs into a grist mill, is forced into the gizzard among the grit. The gizzard is a strong muscular stomach, and it is at work night and day when there is grist to grind, similar to bellows, contracting and expanding, and thus forcing the grit into the grain and triturating the whole mass, after which it is in a suitable condition to be quickly digested.

Fruit Preserving Process.—Professors Hilgard and Smith report that the Perkins process gives a longer preservation of the fruit by the effect of a slow current of air at a temperature from 55 to 65 degrees Fahr., passing continuously over it. That by maintaining this temperature at all times, in the hot desert as well as cold winters, by appropriate means (not using ice) but by the expansion of compressed air, good results can be obtained. Fruit stored by this method will not be covered by condensed moisture, as always happens when ice is used to lower the temperature of a car during transportation, and therefore tends to increase the keeping qualities. The invention is correct in theory, and offers a simple and cheap solution of the fruit storage and transportation problem.

Fruit Trees on the Highways.—Were fruit trees planted along our highways, especially apples and cherries, as they are in some of the German States, our country drives would not only be things of beauty, but they would feed many a needy family and refresh the wayfarer—if everywhere there would be no abuse of them. They would also tend to bring about our homes more of our merry songsters. How shall we begin it?

Potatoes as Feed for Stock.—At the Leipsic experiment station in Germany potatoes have been fed to cows, sheep and swine to test their value. The results justify the directing in advising the use of potatoes when they are very cheap and plentiful. They should be cooked for swine, and for fattening cattle they can be fed either raw or cooked when given with hay, meal and other substances. Cows in milk should be fed daily 25 pounds of washed raw potatoes. The larger potatoes should be cut. As a feed they are not good for young lambs nor for cattle under two years of age.

A bill has been introduced in the North Dakota legislature authorizing the payment of a bounty on all flax fibre raised in that State within the next five years.

Various Soils for Grasses.—In a recent lecture Professor McAlpine, of Glasgow, Scotland, said one of the causes why clover would not grow in places, was the want of lime in the land. Grass with hair on it should not be grown, although it might be all right as far as chemical analysis went, it could not be digested. Timothy is one of the best grasses. Its roots go down and till the land. Meadow fescue is a capital grass, but it takes time. A grass may be quite suitable for one kind of soil and will not succeed on a different kind of soil.

Fertilizers in California.—Fruit growers are experimenting with stable manure, tree and vine pruning, phosphates, potash, nitrates, liquid ammonia from gas works, gas lime, etc., and good results are reported from their use. One instance is reported where one orchardist put from 1,000 to 1,500 pounds of phosphate to the acre on his cherry orchard, and did not require to unscrew the top of his artesian well to irrigate that year.



A HOOVER POTATO DIGGER AT WORK.

Gooseberries.—Are gooseberries a success under irrigation? Would you recommend them as suitable for the family garden? If so, give directions for cultivation, how often irrigated, remedies for mildew, etc. F. S. F., Kansas.

My experience in growing gooseberries for family or market garden is that they are successful, and will be more so in my opinion under irrigation, because when properly irrigated with pruning and thorough cultivation, they will come into bearing early, and bear an abundance of berries for early table or market, coming on even earlier than strawberries.

Yes, indeed, tell every one in the arid regions of America through your valuable journal (which is indispensable to me and is highly appreciated, and every number preserved for future reference) that good crops can be grown by irrigation and cultivation. Now in regard to irrigating, a person should be able to use his own judgment, as some sections do not require as much water as others, but I would refer F. S. F. to the May (1894) issue of THE IRRIGATION AGE, page 218, which contains an article that will give

one an idea, and guide him in the start of irrigation, for too much or too little will "spoil the broth," as the saying goes. So I do not think it best for any one to say how many times to irrigate, as some seasons vary; a dry season requires more water than a rainy one, and vice versa; some localities differ in soils and that would need more water than others with a soil of different character. The remedies I use for mildew can be found in June (1894) issue of THE IRRIGATION AGE, page 262. JOHN C. LEMON, Ferron, Utah.

Books on Vegetable Growing.—If you know of any works published on the growth of vegetables under irrigation that you could recommend, will you kindly advise us where to get them? Would like a work on the potato, cabbage, onion, celery and the strawberry. F. S. JOHNSON, Milford, Neb.

There is no standard work of reference that we have been able to find, treating of vegetable raising under irrigation in the West.

We have read a treatise written by A. E. Gipson, President of the Colorado State Horticultural and Forestry Association, "Horticulture by Irrigation," in which reference is made to a book written by A. N. Cole, entitled "The New Agriculture."

We would suggest that you apply to C. L. Ingersoll, Director of the Nebraska Experiment Station at Lincoln, for such bulletins as have been issued on this subject.

THE AGE contains from month to month valuable information on this and kindred matters. We notice regretfully much conflicting and often erroneous (we think) fruit and vegetable cultural directions given in the columns of the Western agricultural press.

Fertilizing Material.—I write for information (to be answered in your question box) regarding fertilizing material. We have in our vicinity an old slaughter-house where blood tissues, in fact, all of the entrails, have been thrown out for years, and have become dried up for a considerable number of years. Would this material be of any advantage for fertilizing? Would also like to know which book you consider the best on the study of the soil and how to use fertilizers? GEO. S. WISE, Rock Springs, Wyo.

There is no doubt but that the slaughter-house refuse referred to contains more or less valuable fertilizing materials, depending entirely on how it has weathered, the amount of rain which has fallen on it, etc. Dried blood is a standard nitrogenous fertilizer, but nitrogen evaporates rapidly into the atmosphere in the shape of ammonia, and also has a great affinity for water. We would advise you to use this material for a manure if it can be got cheaply.

There is a work, "The Soil of the Farm," which would probably help you. Prof. S. W. Johnson in "How Crops Feed" treats of the origin and formation of soils, and Prof. F. H. Stover in his "Agriculture" gives some interesting information regarding the properties of soils.

We believe that F. W. Sempers' "Manures, How to Make and How to Use Them," being one of the most recent works on manures, gives as full and up to date instruction as any work we know of.

Augustus: "Why do you so persistently wear the hair of another woman on your head?"

Beatrice: "For the same reason that you wear the skin of another calf on your feet."

Professor Henry, from scientific and practical study, declares wheat a better balanced food than corn, its fattening properties somewhat less, but its muscle-building constituents larger; that it is a superior ration for growing animals, its value being about 20 per cent above that of corn.

According to a recent lecture of Professor Schuster, of London, the safest course for a human being in a thunderstorm is to get thoroughly wet. Benjamin Franklin remarked that he could kill a rat when dry by means of an electric discharge, but never when it was wet.

To ascertain the age of eggs dissolve a quarter of a pound of salt in a quart of pure cold water, then drop in the eggs one at a time. If a day old an egg will settle to the bottom. If three days it will float. If more than five days old it will rise above the water in proportion to its age.

Use extra care in storing potatoes for winter. Don't put them under the house.

Every farmer should know something of forestry. Trees are necessary everywhere.

Two heavy horses will do more work than three light ones.

Separate, separate, separate the good from the bad. Poor hogs, poor cattle don't pay.

Don't feed the hens too well or they will get broody.

The profitless cow should go.

DARKEY SAYINGS.

De blindes' mule can see de corn in de troff.

Hongry folks don't quarrel about de plate or spoon.

De tricky hoss won't balk a-pullin' at de fodder in de rack.

Dem weeds don't need de gwanner smell to coax 'em in de patch.

De high hat ain't allus a sign ob de gentleman.

Jones: "That chicken is fourteen years old."

Smith: "How can you tell the age of a chicken?"

Jones: "By the teeth."

Smith: "By the teeth? Chickens don't have any teeth."

Jones: "But I have.—*Crypt.*"

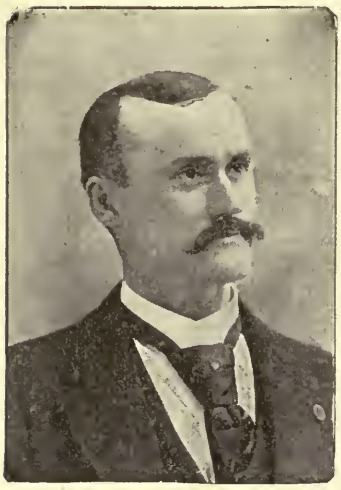
In order to sleep well, is it best to lie on the right side or on the left side?

Answer.—If you are on the right side it isn't necessary to lie at all.

There is one chop house the tramps do not like, and that is the woodshed.

PULSE OF THE IRRIGATION INDUSTRY.

LEADING DELEGATES AT THE CONVENTION.



E. R. MOSES, OF KANSAS,
Chairman of the National Executive Committee.

THE election of E. R. Moses, of Great Bend, Kan., as chairman of the Executive Committee at the recent Fourth National Irrigation Congress, was a tribute to the growing importance of the great plains country. Mr. Moses has long been one of the foremost representatives of irrigation in Kansas, but his field of work is now broadened and there is every reason to believe that in his hands the work of the propaganda will be carried forward on a scale commensurate with the merits of the irrigation cause. Being thoroughly familiar with the irrigation problems which confront the friends of irrigation in the semi-arid region it is naturally expected that these will first receive his attention, but no section of the Great West will be overlooked in the campaign plans which Mr. Moses is now formulating. In this work he will be ably assisted by his friend, Judge J. S. Emery, the National Lecturer and the other members of the National Committee.



JOHN E. FROST,
President of the Congress and Land Commissioner of the A. T. & S. F. R. R.

AMONG the many warm friends of irrigation holding official positions on the Western railroads, John E. Frost stands in the front rank. Early recognizing the great importance of the subject he has steadily and persistently advocated the settling and developing of the Western country under a practical system of irrigation. Being a man of large ideas and with the energy and perseverance to carry them out to the fullest extent he has attained considerable prominence and as an expression of the esteem in which he is held he was unanimously elected president of the Fourth National Irrigation Congress, over which he presided with ability and dignity.



JOHN E. SAINT,
of Albuquerque, Chairman of Local Committee.

ON every side are heard the praises of the work accomplished by the Entertainment Committee of the recent Congress, of which John E. Saint was chairman. The hospitality was dispensed in true Western style and delegates and representatives were pleased and gratified at the manner in which they were received and cared for during their visit. Mr. Saint and the other members of the committee were untiring in their efforts to accommodate and entertain the large number of visitors.



THOS. M. KNIGHT,
of Missouri.
Member of the National Executive Committee.

EMINENT among the members of the engineering profession who devote their time to the solution of irrigation problems is Thos. M. Knight of Kansas City. An authority on all matters relating to the particular branch of the profession in which he is interested, his services are always in demand. At the present time he is the chief engineer of a large enterprise and the consulting engineer of several others. At the Albuquerque Congress he was re-elected as Missouri's representative on the National Committee.



J. F. MUELLER.
Editor of the Milling Magazine

THE genial editor of the Milling Magazine has become a convert to irrigation and is now preaching the small irrigated farm idea through the columns of his journal. He believes that the millers will benefit by the practice of irrigation for several reasons. The grain grown will be of a better quality, and the yield per acre will be greatly increased. The farms will be reduced in area and clustered around the village and therefore the distance from the farm to the mill will not be so great, thus saving much of the farmers' time.



THOS. FROST,
Member of the National Executive Committee for Minnesota.

ONE of the rising young lawyers of the bustling city of Minneapolis is Thomas Frost, who was elected a member of the National Executive Committee at the recent Congress. Mr. Frost stands as the representative of a Northern State which has not as yet adopted the practice of irrigation to the same extent as many of her Western sisters, but judging from indications recently manifested it will not be long before the thrifty farmers of Minnesota will greatly increase their yield of agricultural products by a practical system of artificial watering.



J. V. ADMIRE,
of Oklahoma.
Member of the National Executive Committee.

THE great Southwest was fully represented at the Fourth National Irrigation Congress, and among the leading delegates was J. V. Admire of Oklahoma. Mr. Admire is an energetic and successful business man, the publisher of a newspaper, and interested in several other enterprises. He is a stanch advocate of the possibilities of Oklahoma and can foresee the day when his chosen section will stand among the ranks of the most prosperous communities of the West.



J. S. ATKINS, OF TEXAS

IN an article in this number the advantages of Southwest Texas are vividly portrayed by J. S. Atkins of Portland. The outlook in Texas is indeed bright and already the influence of the favorable legislation recently enacted is beginning to be felt. Capital is inspired with confidence when it is assured that proper precaution will be taken to protect it. Mr. Atkins has been a faithful and tireless worker in behalf of the interests of the great State of which he is so proud and he is looking forward hopefully to the developments which will follow the opening of the deep water harbor at Aransas Pass.

Send for a copy of THE IRRIGATION AGE premium list. No other publication offers such valuable premiums. Young people can make money soliciting subscriptions for THE AGE.

PROGRESS IN UTAH.

THE following extracts are taken from the report of the Utah commission to the Fourth National Irrigation Congress, presented by C. L. Stevenson, secretary of the commission:

The impetus given through the Irrigation Congresses has been most marked in our Territory; in fact it may be called a "revival" in a region which was the forerunner in showing what could be accomplished through irrigation in the inter-mountain region known generally as the "Great American Desert."

During the past year we may be said to have fairly inaugurated in Utah the era of reservoir construction for irrigation purposes, thereby making available three times the amount of water possible to obtain heretofore from our streams. In no region probably has there been exhibited a stronger opposition to the impounding of water by construction of dams; this opposition has been natural enough from the many disasters which of late years have accompanied badly constructed impounding reservoirs.

With the increasing knowledge that under proper engineering surveillance safety and greatly enhanced supply can be had, great advances are now being made, and one of the factors that tended most strongly to do away with this sentiment was the great success of the people of Gunnison, who with a few hundred of dollars constructed an earthen dam some thirty feet high across a small stream known as the San Pitch River, and which during the irrigating season dwindled to a flow sufficing for only a few thousand acres, the winter and spring flows enabling the reservoir to be twice filled, and this season their dam will be raised another five feet and by also draining some of the small affluents the Gunnison irrigation district now covers 25,000 acres.

The success of the Bear River dam, or rather diverting weir across that river, further strengthened the belief that dams could be built which would stand all freshets. It may be well to here state that the Bear River company's works are among the largest irrigation plants of the West. At a cost of nearly $2,000,000, there is here over 100 miles of canals, with towns and settlements thereunder, already covering 315 square miles of most fertile lands, part being colonized. During the past year 5,000 acres have been placed in cultivation, 40,000 fruit trees set out and an extensive grain elevator constructed.

Among the first to go extensively into the impounding of water we find the works of the Clear Lake Land and Irrigation Company situated on the Sevier River, near Deseret, in Millard County, where Swan Lake and a series of smaller lakes are connected, and raised by dams to cover some twelve square miles of surface, which reclaim upward of 15,000 acres.

Near the south end of Utah Lake is the extensive reservoir and canal system of the Mt. Nebo Irrigation company. The works of this company are of a more expensive character than the average, due to the first class methods of construction and the character of the country. Their dam across Current creek conserves water enough for irrigating 25,000 acres adjacent to the town of Goshen.

The boldest project now under way is that known as the Mammoth reservoir on Gooseberry creek in Sanpete County, eight miles east of the town of Fairview. The dam of this company will be a most

massive structure of earth and of stone masonry 125 feet high. As there are very few higher dams than this in the world it shows the immense progress made in engineering work and in public opinion of the advisability of such great structures. This reservoir will store 60,000 acre feet of water.

In summing up we find that there has been inaugurated and under construction irrigation works for watering over one-third of a million acres. Not the least important feature of this progress is the greatly improved character of all the works now being built, whereby a saving in the cost of annual maintenance is being brought about. Another pleasing feature is that the younger generation of Utah, educated naturally to irrigation methods, is rapidly settling up these newly opened regions. The vastly improved methods of construction, moreover, has not enhanced the cost of a perpetual water right; for in Utah it is the rule that the land and the water go together and that the owner of the land eventually becomes the owner of the right to use the water.

Another gratifying feature is that the duty of water is being greatly enhanced, our people are learning that much less water suffices for a given acreage while an increase in products is also brought about.

The year's record of active work has more than ever emphasized the Utah system of building even great irrigation works by association, by co-operation, by swapping land for both labor and material, and by making a beginning finally construct the whole without debt.

A forestry association, composed of some of the best educated and thinking men of this region, who are earnest workers, is already doing good work to not only save what we have left of our forests, but also by "parking" to promote forest growth all along the lines of the headwaters of our streams.

In this connection, however, the best results effected has been the forming of the State Irrigation Association of Utah. As a potent factor in promoting irrigation and all cognate matters this will probably do much to educate our people and keep them in the front rank of irrigation agriculturists. The machinery of this organization is simple but we believe effective.

THE IDAHO REPORT.

IN his report to the Fourth National Irrigation Congress, D. W. Ross, the member of the committee from Idaho, very clearly outlines the work accomplished in his State during the past year.

A portion of the report follows:

The Idaho Legislature last winter enacted, not without bitter opposition, three very important irrigation laws.

The first act emphasizes constitutional provisions, defines more in detail the relation of the irrigator to the company, prescribes for the care and supervision of laterals and the compulsory election of Water Masters by the irrigators themselves. In the case of irrigation companies (not mutual) provisions are made for an adjudication of rates charged for water upon petition by the irrigators to the District Court. Such companies are to furnish a release to the purchaser of a so-called water right from all its liabilities and bonded indebtedness. All payments due such companies for the use of water shall become a first lien against the land or crops upon which water has been used.

The second law enacted is a District Irrigation Law, so similar to the "Wright Law" of California that it needs no description in these lines. This law, based upon the local needs and natural conditions of the State, was demanded by the people, and is believed to be just and proper. It has for its object the construction and maintenance of canals for irrigation by the district which is to be benefited by them, the merging of corporate interests into that of the land owners in the case of canals already constructed and owned by companies.

The effect on the State at large will be great, as the speculative feature will be eliminated as nearly as possible, and irrigation development in Idaho will afford a safe investment to capital.

The immediate effect, locally, will be an opportunity for the irrigator to secure water at actual cost, a stimulation of the business instincts of the people and a fostering of the spirit of co-operation and home industry.

The last but by far the most important measure adopted was the acceptance by the State from the United States of the million acre grant under the provisions of the "Carey Act" and the adoption of a business plan governing the reclamation of the same. This act also creates the office of State Engineer.

It would be impossible to even outline in this brief report the far reaching effects to our State of the developments made possible under this act.

As agriculture will become one of the greatest industries of Idaho, as it is desired that all who live in our State shall own their own homes, and as in the greater portion of Idaho homes must be made by means of irrigation, we advise the people, when making application of these laws, to act in a conservative manner and to preserve, inviolate, one provision which is now incorporated in them, the provision which will ultimately lead to district ownership of all canals and water for irrigation.

The developments which are likely to begin soon under provisions of the grant of Congress will employ many of the brightest minds in the State, will furnish labor to thousands and homes for tens of thousands.

IRRIGATION PROSPECTS IN NEBRASKA.

BY I. A. FORT.

DURING the past two years the progress of the development of the irrigation sentiment has been rapid. Nebraska has taken a forward step in the construction of irrigation canals, that have as now constructed, a capacity to irrigate fully 1,000,000 acres. At the present time the question is not alone one of irrigation but how can we irrigate. The Gospel of Irrigation has become an accepted principle in this state.

A recent decision of the Nebraska Supreme Court on a case that involved the rights of riparian land or water-right owners has, to a limited extent, checked the development of irrigation enterprises. Just how far this decision will affect the Nebraska Irrigation Law is a question to be decided soon by the same court. There are now pending in this court two other cases that will fully test the laws passed at the session of the last legislature, the case of Paxton & Hershey vs. the Farmers and Merchants Canal Co., of Lincoln County, Neb., and the test case of the Alfalfa District Irrigation Co. formed under the "Wright Act" of Nebraska of Keith County.

If the recent decision of the court that the rights under our State constitution of riparian land owners still exist then the irrigation laws and interest have

received a severe blow, as applied to the canal system. On the question of pumps and windmill irrigation, the people are becoming aroused; the great success that the new irrigation windmills have achieved has aroused a hope that on every farm in Nebraska where the depth to water does not exceed 200 feet there can be from five to twenty acres or more irrigated. Digressing slightly, will say that experts claim that the new 12-foot irrigation windmills have five times the power that is allowed for the old-fashioned 12-foot farm mills. They are now working three 12-foot mills on twelve and fourteen inch pumps, with a stroke of from ten to twelve inches lifting water from twelve to twenty-five feet in height. It is claimed that the 16-foot irrigation mill will lift water enough to irrigate ten acres pumping from a depth of 200 feet where economy in water is used. So this method of irrigation will go on, even if our laws are nullified, which we trust will not happen.

After making such a splendid start on this method of farming it is to be hoped that nothing will mar the progress of the sentiment favoring irrigation. Yet even with the decision of the Nebraska Supreme Court in favor of the Wright Act of our State, the decision of Judge Ross, of California, on the case tried in his court and now pending in the United States Supreme Court must affect our district law, and until such a time as a decision is rendered, the district act will, to a certain extent, be checked or inoperative. With the two decisions pending in Nebraska Supreme Court and one in the United States Supreme Court that will thus affect our laws irrigation works of every character have received a check.

There will be progress, however, in Nebraska on this question, in the way of education, as the people everywhere are taking a very active interest on the subject. One of the largest loan and trust companies in the State that now holds a number of thousand acres of Nebraska lands has commenced work and has arranged for a series of lectures on irrigation by pumping, along the lines of the Burlington and Missouri River Railroad in Nebraska, where canals cannot be constructed.

One of the most powerful factors in the spreading of this sentiment is the total abandonment of the theory of the increase of rainfall that was to have followed the settler in his march Westward; even our State college officials now urge the abandonment of this theory and prove that it is a fallacy; had they attempted this five years ago, off would have gone their official heads and they would have been branded as enemies to our State and its interest.

Prof. Chas. E. Bessey, the botanist of the State university, is earnestly and actively urging the relinquishment of the remainder of the United States land to the State, to be accepted by the State and be converted into a great forest reserve that will be owned entirely and controlled by the State, and to be held solely for that purpose and no other, title only to remain with the State on condition that it becomes planted to timber after so many years.

The idea of Professor Bessey is that such a theory is practical and that in time this vast body of timber would very materially affect the climate of Nebraska and the plains. This reserve would be very largely on the north side of the North Platte river, in what is known as the sand hill and lake region and all west of the one hundredth meridian.

Professor Reece, of Falls City, is actively and energetically pushing his atmospheric irrigation idea, that if it would be carried out would also affect the climate of the great Plains. Many persons are following Prof. Reece's advice. Our State Commissioner is adjudicating the filing of water rights that have been made in the past ten years. Nebraska is making steady progress and will yet lead the nation in the amount of its irrigated area.

IRRIGATION IN WASHINGTON.

BY ARTHUR GUNN.

THE valley of the Wenatchee river, in the exact center of the State of Washington, is being rapidly developed by means of irrigation. Two canals are now under construction—the Peshastin Ditch canal and that of the Wenatchee North Canal Co. Both of these canals were originally planned by the late C. F. B. Haskell, C. E., and the construction of both is now under the charge of Mr. Harvey Shotwell, the resident engineer.

The Peshastin Ditch Co.'s canal takes its water from the Peshastin river, about two miles above the confluence of that stream with the Wenatchee river. The canal is twelve feet wide at the water line and will carry two feet of water. Its length is fourteen miles, covering a little over five thousand acres of land tributary to the town of Mission. The earth work of this canal is now finished, and there remains but three-fourths of a mile of fluming to be built before it will be complete. It will be done in time for the crop of 1896.

The Wenatchee North Canal Co. is so named in distinction from another proposed corporation, the Wenatchee South Canal Co. The North Canal Co. is now actively engaged in building a canal which when completed will be twenty-two miles in length, and will completely cover the arable land upon the north side of the Wenatchee river from opposite the mouth of the Peshastin river to the mouth of the Wenatchee river. It is proposed to organize the Wenatchee South Canal Co., which will take water from the North canal, two miles above its lower terminus and carrying it across the Wenatchee river, supply that part of the valley immediately surrounding the town of Wenatchee.

None of these works present unusual engineering difficulties, except the South Canal, which will have to cross the valley of the Wenatchee from bluff to bluff, a distance of about one thousand feet, and a depth of about three hundred feet. The main point of interest arises from the fact that these works are being successfully pushed to completion by the local farmers, who are men of limited means, entirely without aid from outside capital; showing both energy and faith in the future of the Wenatchee valley under irrigation. The total value of these canals when completed will not be less than $100,000.

In addition to these larger canals there are numbers of smaller ditches; all the small streams which here come down from the mountains having long since been diverted and used to their entire capacity. However, the total acreage covered by them will not exceed three thousand acres, making the larger canals a necessity for the development of the valley.

The Wenatchee valley is justly famous for the quality of its fruit, its low altitude and sheltered position insuring early crops and freedom from injury to trees in winter. Since the building of the Great Northern Railway through this valley, three years ago, fruit raising has taken a vigorous and healthful impetus, and will soon make the Wenatchee valley one of the most beautiful garden spots on the Pacific coast

LARGE CANALS IN ARIZONA.

BY G. M. FOWLER.

THE tendency of irrigation works in Arizona is toward schemes of greater magnitude and increased cost, including storage reservoirs in the mountains, and water-tight dams at the point of diversion, to save all the underflow.

These larger systems are more economical, both in amount of water delivered and in cost of maintenance, than were the smaller ditches which are being superseded, and the results are beneficial to all concerned.

As an instance, the water belonging to the Tempe Canal Company, which heretofore has been diverted from Salt River, at a point where the head of their ditch was located, is now to be brought around through the Mesa Consolidated Canal, which has its head works several miles farther up the river, to a point where the center body of water can be dropped over a bluff thirty-five feet high. Here the Mesa Consolidated Canal Company propose establishing an electric power and pumping plant that will raise many hundred inches of water out of the sand beds below on to the *mesa* above, where it can be used for the purposes of irrigation. Thus, with a little more capital invested, the swift-flowing waters of the canals can be made to do double duty, turning the wheels of mills and factories before being distributed over the fields of grass and grain.

In the use of water, the progress has been toward the smaller farm unit and a closer and more careful system of irrigation. Special crops that pay are taking the place of former unprofitable productions, and the resulting prosperity is to be seen on every hand.

The future of the Salt River valley is a bright one. It is pre-eminently a land of homes—of healthy, prosperous, happy homes. To the newcomer it is an oasis in the desert. After five hundred miles of barren mountains and sandy plains, its green fields and cool shades, its fruits and its flowers, its soft breezes and sweet perfumed airs, all impress the visitor as being something incomparably delicious and invitingly nice. Phœnix is an enchantress, risen again, and nine-tenths of those who come within the limits of her spell never leave it again without regret.

KANSAS CROPS.

A. C. ROMIG.

IT is eminently proper at the close of the harvest season to take a retrospective view and summary of results, which have not in all cases met our expectation, but are, nevertheless, highly educational and demonstrate the possibilities along the line of irrigation.

Where failures have occurred, the cause is easily traced to a want of experimental knowledge and skillful management; these are breaks that will be mended another season.

As to crop results, we have as high as 200 bushels potatoes, 800 bushels onions, tomato vines twelve feet high and yielding a ratio of 2000 bushels per acre, celery of superior quality, measuring ten inches around the bulb, strawberries of extraordinary size, quality and yield, and other vegetables in proportion.

Our farmers are fully awake to the necessity and value of irrigation; they contemplate enlarging their present plants, establishing new ones, and will extend experiments to include cereals, orchards and alfalfa. But for the impoverished condition of farmers, resulting from four consecutive years of crop shortage, an irrigation plant and oasis would ornament nearly every farm, and windmills would dot the prairies as they do the polders of Holland; but for this consummation devoutly wished, we must wait.

The progress and development of irrigation is seriously threatened by recent court decisions in this State and Nebraska on the question of vested rights of mills, giving to the miller precedence over the irrigator in the use of water. This will affect us along streams where mills exist, and may necessitate the digging of large wells at a distance of ten, twenty or thirty feet back from the shore, and using the water as it percolates into the well in defiance of vested rights, and to the confusion of the miller.

Notwithstanding the above drawback, the friends of irrigation are exceedingly hopeful, and feel that we have reached a basis of permanent prosperity, and a condition that will eliminate the dread nightmare of drought and crop failure.

DEVELOP THE UNDERFLOW.

H. V. Hinckley of Topeka, Kansas, representative of the American Society of Civil Engineers, speaking on the subject of water supply, said that the greatest drawback to irrigation development to-day is found in the sad mistakes that have been made in previous years from poor judgment and too often from poorer motives. He urged that an engineer who would call himself an irrigation engineer should first solve the problems that nature has placed in front of him, and then find only the bare, cold facts, keeping clear from promoters "for revenue only," out of wild-cat schemes and above interests in bond issues, keeping up the proper standard of the profession. "Ability to run a line of canal levels does not make a man a competent engineer on irrigation problems," he said. "Too many canals have been built and are now being built, where the reliable water supply is not a canal supply."

He claimed that the United States Geological Survey is spending thousands of dollars annually in chasing after the five per cent. of the rainfall that finally runs away to sea. He said he would not criticise the government for doing this important work, but he would suggest the propriety of giving a little attention to the other 95 per cent. "It makes a great difference whether 'Arid America' shall eventually sustain twenty million or a hundred and fifty million people," he said, "and before we get through, the utilization of the underflow by pumps and gravity systems will be found to be the biggest factor in the solution of the great problem. Thousands of individual pumping plants are already irrigating from the underflow in Western Kansas alone. The city of Denver uses thirty million gallons a day, delivered to its pumping station by gravity from the Platte underflow, and the advantages of nature's subterranean storage have not as yet fairly begun to be appreciated."—*Albuquerque Citizen.*

The woman who laughs in her sleeve these days must develop a loud tone or her efforts will be lost.

THE PUBLISHERS' DEPARTMENT.

CONSTRUCTION OF DITCHES.

Among the many labor-saving and economic machines invented within the last quarter of a century, there is none that has been more successful than the New Era Grader and Ditcher. In the irrigation districts, particularly, it has afforded the means of construction of ditches so cheaply that people who had become impoverished by successive failures of crops to such a degree that they could not afford the expense of constructing large irrigation enterprises by old-time methods, have by means of the New Era been able to secure the rapid and cheap construction necessary to give them water for their coming season's crop, and at a cost within their means.

The earlier machine, known as the Wauchope, was subjected to fifteen years of study and improvement and then the New Era was evolved, new patents obtained, and what was then considered a perfect machine put upon the market; since then, constant study has resulted in such further improvements that as it now stands, it can be well pronounced as perfect a machine for its purposes as any invention of the age for any other purpose. There are but few people residing in the Middle or Western States but are familiar with the New Era or its earlier prototype, as during the past twenty-five years, tens of thousands of miles of country roads and ditches have been constructed by their use, thousands of miles of railroad beds, and thousands of miles of large irrigating canals and laterals, while on large work such as levee construction, or the cutting down of hills, loading wagons, and filling up hollows, Western cities employ them. Nor is the fame and reputation of the New Era limited to America, but the machines are used in various countries around the world. The New Era will construct shallow ditches of any size, for when it becomes necessary to construct a canal wider or deeper than the New Era can deliver from the earth directly, it can be used as a wagon-loader, and then limitations end.

Small ditches are rapidly and cheaply constructed with the Austin Reversible Machine. This machine is also very desirable on large irrigation work, where there frequently occurs necessity of removing earth beyond the delivery of the New Era, also on side-hill work the opening can be made on a steep hill by a blade machine, so the New Era may be used, when otherwise the slope of the hill would be too great for the New Era to work, and the blade machine by cutting level tables would enable the New Era to handle the larger work.

The Austin Wheeled Scraper is the result of long and careful study by experienced contractors and mechanical experts, of the various scrapers in use, with a view to producing an implement free from the various objectionable features so noticeable in other and earlier styles. The especial advantages of the Austin over all other styles are, that when in position for loading it is absolutely locked so that it cannot be dumped; that when loaded, by the great leverage, in connection with the movement of the team (which assists in raising the load), it is more easily broken out of the ground and lifted; when lifted, it hangs higher from the ground than any other make, is perfectly balanced with the point well up to avoid wasting, and having higher wheels runs lighter and more steadily; that it has an adjusting screw at rear end of pole for arranging proper height of draft for small mules or large horses, on any kind of work, and there is no down draft on the pole to chafe the necks of the horses. It dumps readily and easily on level and irregular surfaces. Draft irons, levers, hangers, etc., are all straight, no bent angles to break; all pivotal points steel bushed; when worn they may be readily replaced; axles attached so they cannot spread the wheels at the bottom, causing heavy draft and rapidly wearing away the spindles. It is made in three sizes.

For more detailed information write direct to F. C. Austin Manufacturing Co., Carpenter street and Carroll avenue, Chicago.

BARNHART EXCAVATORS.

The accompanying illustration shows one of Barnhart's Ditching Dredges owned by A. V. Wills & Co., of Pittsfield, Ill., and in operation in the Scioto Marsh, near Kenton, Ohio.

This machine was built by The Marion Steam Shovel Company, of Marion, Ohio, who are manufacturers of excavating machinery of over thirty different styles and sizes, and adapted to all classes of work. Where there is sufficient water to float a dredge, they have their floating machines, and for work where it is impossible to have water until after the ditch is constructed they have their traction dredges and Kings County Ditchers. This company have the largest plant in the United States for the manufacture of this class of machinery; and, being equipped with all modern appliances, they are abundantly able to take proper care of their many customers by furnishing a first-class machine at a moderate cost. In simplicity of design these machines stand at the head; and, there being less parts there are consequently fewer complications and not so many parts to replace with repairs. These machines are being used in all portions of the United States, and in Mexico and Canada. It is possible with this class of machines to excavate to a depth of from nine feet to twenty-five feet, dump at a height of from fourteen feet to thirty-four feet, and at a distance of from thirty feet to eighty feet from the center of machine to center of dump on either side. The ditch shown in illustration is forty feet top, thirty feet bottom, and an average depth of over four feet. The material excavated is hard pan and boulders. The capacity of dipper used is one and one-half yard, the machine having a record of two thousand feet of ditch in six days' work of ten hours per day.

How many feet are there in one yard?

Tommy: "Well, about a thousand, if you count all the chicken tracks in the new flower beds in our yard."



BARNHART DREDGE AT WORK BUILDING A DITCH.

A GRADE LEVEL.

The Jackson Grade Level Co. manufacture an instrument which any farmer can use in the construction of ditches, thereby saving the expense of an engineer at ten dollars a day. They are exceedingly simple in operation, and as the cost is but twenty-five dollars, they pay for themselves in building one ditch. Write to the manufacturer at Jackson, Michigan, for fuller particulars.

A GASOLINE ENGINE.

The Witte Iron Works Co., of Kansas City, Mo. have recently gotten out a handsome catalogue of their latest improved Gasoline Engine, which shows all the uses to which they may be put, gives a great many testimonials in various lines of business, and states some plain, hard facts which purchasers of such engines ought to read before buying. By holding strictly to the facts this company is building up a large business on these engines. If information, etc., is desired, address as above.

HOT AIR ENGINES.

Water is the greatest necessity on a farm. It is not a difficult matter to find the supply, but to convey it where required becomes a question of much importance to a farmer. Dependence has heretofore been placed on the windmill, but you cannot always have the wind. There is a pumping engine specially designed for pumping water that is taking the place of the windmill. It is so simple in construction that a child can manage it. It is absolutely safe, requires no steam, and has no valves. All that is necessary is to start a fire. The hot air from the fire starts the engine and keeps it going, and with proper piping, water can be sent anywhere on the farm—to the house, barn, garden, etc. If any of our readers want to know about this engine, they should write for free catalogue to the manufacturers of the De Lamater Rider and De Lamater Ericsson Hot Air Pumping Engines. Address De Lamater Iron Works, 87 South Fifth avenue, New York, N. Y.

WATER PIPE.

The Spiral Riveted Water Pipe, manufactured solely by the Abendroth & Root Manufacturing Company, 28 Cliff street, New York City, is in great favor for irrigating and ranch water supply purposes. It is extremely light in weight, while very strong and long-lived. For underground use it is asphalted and will not corrode. The Hon. R. M. Widney, of Los Angeles, Cal., in a letter to the manufacturers, says: "The Spiral Riveted Pipe and Couplings for Hesperia are doing first-class work, keep in perfect order, and no leaks. No pipe could be better. On February 26th inst., I uncovered a part of it, and found the asphaltum coating in perfect order. From present appearances, it will last for centuries."

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The stories must not exceed **One Thousand Words** in length, and must be written by boys and girls under twenty years of age. They must relate some actual or imaginative circumstance occurring at Christmas time, on an irrigated farm or orchard, or at the home of a farmer or fruit-grower.

The stories should be received at the office of THE IRRIGATION AGE not later than December 2, 1895. Three impartial and disinterested judges (**Dr. Chas. Stirling, Mrs. Alice Houghton and Rev. John Rusk**) will decide upon the merits of the stories submitted, and the author of the one selected as the best will receive **a Cash Prize of $5.00.**

The second best will be entitled to a year's subscription to THE IRRIGATION AGE **FREE.** The stories selected will be published in THE IRRIGATION AGE. The awards will be made on **December 15.**

Write on one side of the paper only. Your name and address must accompany the copy, *but must not be on the same sheet.* Address,

LITERARY EDITOR
34 CLARK STREET, THE IRRIGATION AGE
CHICAGO.

CABLEWAYS.

An interesting fact to contractors is revealed by the use of the various systems for handling rock on the Chicago Main Drainage Canal. A day's work for a man in filling lime-stone into shallow skips, as used on the Lidgerwood Cableway, averages between sixteen and seventeen cubic yards of rock in place for each ten hours' work, while the work of filling the cars, which are about three feet high, averages only about nine cubic yards per man. This is a remarkable saving and alone would justify the use of the Cableway in hundreds of localities. It may be mentioned in this connection that there are now twenty Lidgerwood Cableways (manufactured by the Lidgerwood Manufacturing Company, New York City), in use in the construction of the Chicago Main Drainage Canal.

A NEW AUTOMATIC RAM.

As is well known, the ram was first invented by a Frenchman, in 1786, and notwithstanding the fact that thousands of rams have been built and sold annually, the manufacturers have failed to materially improve the old "Berlier Ram."

In 1887, an American genius, named W. A. Rife, of Waynesboro, Virginia, invented, designed and patented the Rife ram, which is supplied with *air automatically* by means of peculiar construction of the base, thus enabling him to build the Rife ram to any requisite capacity, and fill a demand long felt, and place on the market a ram admittedly the only practical air-fed large ram in the world. These rams are used in elevating water for irrigation, small towns, railroad tanks, colleges, on farms, etc., etc., as well as all smaller demands. Another wonderful improvement made by Mr. Rife is that by using a common check valve on the Rife Ram it becomes double acting and will deliver one kind of water, using another water as power, and the two waters cannot possibly mix, which is of special value.

At the World's Fair, in Machinery Hall, one of these rams was in constant operation delivering seven thousand gallons per hour, and at a cost of less than two cents per day. This ram received the highest award, medals and diplomas.

These rams are being now used in irrigation, and where conditions favor their location, no method can be as economical. Diversified farming is becoming imperative and any economical method of supplying water must prove a great boon to many who have water running to waste and lack an economical method of applying it to the growing crops.

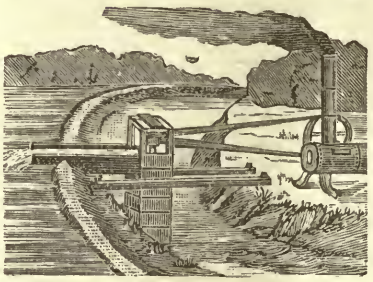
The Rife Engine Co., Roanoke, Virginia, manufacture these rams, and full particulars, illustrated catalogue, etc., will be sent upon application.

B. L. GREIDER, Hydraulic Engineer.

A SUBSOIL PLOW.

Among those pioneers of Kansas whose restless energy, fanned by the ever present prairie breeze, has built up the most remarkable State in the sisterhood, in 1857 there settled in the city of Topeka, A. B. Perine,

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YOU CAN irrigate without them.
YOU CAN own your own water supply
YOU CAN DO IT WITH THE "Menge Pump"



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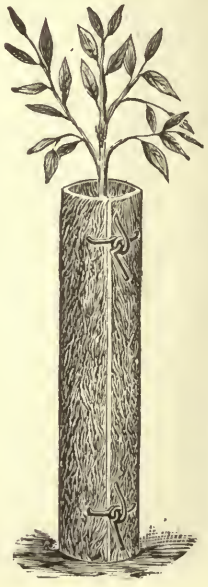
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at that time a common blacksmith, for whose forge no job was too small. In those days the demands for good plows and sharp were far greater than for other implements of any kind, and it did not take Mr. Perine long to secure sufficient work in this line to enable him to devote his entire time to it.

For nearly forty years, with a constantly increasing demand for his goods, and an equal increase in the facilities of his shop for their production, Mr. Perine has devoted himself to The Plow and that alone. His careful study of the demands of the Western soil, and the best kind of a plow with which to meet this demand, resulted a little more than a year ago in the first subsoil plow that was put on the market, with a long, narrow blade, wider in front and gradually tapering back, and with a long, gentle "raise." Since Perine's plow has been on the market its value has been so quickly recognized that more capital and greater facilities have been needed to supply the demand. The Perine Plow Co. has been organized and the shops twice enlarged.

Perine's Subsoil Plow is constructed of the best material, and designed to stir, and break and loosen hardpan, gumbo, clay and all kinds of subsoil. It runs edgewise in the ground, the front edge being the thickest, which on No. 1 is two inches thick; the back edge is three-fourths of an inch thick, which prevents all friction on the sides. The plow has a long, gradual curve up from the point, which insures comparatively light draft, as the hard soil is broken in pieces before it reaches the abrupt portion of the plow. The point, which really is the business end of the plow, projects about two feet in front of the standard, where it attaches to the beam, and is made of excellent steel, rolled at the mills especially for these plows. The point comes up high on the standard and is thicker than the standard, and therefore takes all the wear there is on the plow, except bottom of heel, which has a piece of steel tempered extremely hard and riveted to heel, and when worn out can be easily replaced. It is designed for hard service and generally gets it.

TO MANUFACTURERS.

The State of Wisconsin, with its inexhaustible timber and iron resources, affords the manufacturer a great many advantages over other States. Among the advantageous features are, its central location, nearness to good markets, superior quality of labor, healthful climate, good level surface of land upon which to operate, pure water, and many other things which are so necessary to the success of a manufacturing establishment. The Wisconsin Central Lines cover the best portion of the State and reach the great commercial centers of the West. Along this popular line are to be found first-class locations for industries such as tanneries, iron and wood-working establishments, paper and pulp mills, cotton and woolen mills, brick and tile manufacturers, stone and granite contractors, canning factories, etc., etc.

For detailed information, address W. H. Killen, Industrial Commissioner, W. C. Lines, Milwaukee, Wis.

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DENVER, COLORADO.

POULTRY PRODUCT.

Not many farmers are aware of the magnitude of the poultry product of the United States. The cow is so much larger than the hen that she is apt to be looked upon as being more important, but the facts are, the poultry product is more than double that of our dairy product. It behooves farmers, therefore, to look well after the poultry industry, and to do it rightly, a first-class incubator should be used. "THE RELIABLE," manufactured by the Reliable Incubator & Brooder Co., Quincy, Ill., which has made such a grand record at the World's Fair, and which has been victorious in every contest since, offers this year additional improvements. This incubator is now on exhibition, in constant operation, at the International Cotton Exposition at Atlanta, Ga. They publish a book on poultry, giving full description of "THE RELIABLE," also other valuable information for poultrymen, and will send it for the nominal fee of four cents in stamps.

ADVERTISING IN THE TRADE JOURNALS.

Manufacturers and others contemplating the use of what are termed Trade Journals for advertising purposes, and who are desirous of securing the best possible return for their money, should correspond with the Manufacturers Advertising Bureau, 111 Liberty street, New York City. This concern has, by twenty years' experience in placing the advertising of many of the largest and most successful advertisers in the country who use mediums of this character, acquired a practical knowledge of how to make trade journal advertising profitable. Its methods are unique, time and labor-saving, and have received the indorsement of publishers and advertisers alike.

CREAM SEPARATORS.

There have recently been several important decisions in the United States Courts regarding centrifugal cream separator patent rights, which are deserving of the attention of those interested in any way in these machines.

On June 18, Judge Coxe, sitting in the United States Circuit Court for the Northern District of New York, at Canandaigua, N. Y., granted a decree, inclusive of a perpetual injunction, sustaining the material claims of the Von Bechtolsheim patent, better and commercially known as the "Alpha" De Laval patent, in the suit of The De Laval Separator Company, of New York, against Samuel Hotchkiss, of Delaware County, N. Y., who had been making and selling a cream separator with an interior bowl device, thus held to infringe the "Alpha" patent as charged by The De Laval Company.

These decisions are of no little interest to creamerymen and dairymen. The centrifugal separator patents have long been in litigation. The De Laval Company was practically the pioneer in the introduction of these machines, but of late years various concerns previously making gravity cream-setting appliances have taken up the manufacture of the centrifugal machines as well. The De Laval Company has bitterly resented this trespass upon its claimed rights, and infringement proceedings under its patents, in which it claims to have invested and expended nearly a million dollars have been brought in several States.

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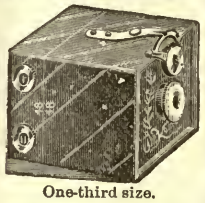


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AERMOTORS.

The Aermotor Company of Chicago has one of the largest wind-mill manufacturing plants in the country. Its daily out-put is enormous and carloads are constantly being shipped to all sections of the United States as well as foreign countries. To meet the increasing demand for windmills and pumps especially adapted for irrigation purposes this company is now manufacturing several styles which are undoubtedly the best and most economical on the market. Mr. Noyes has invented a pump which reduces the loss of power by friction to a minimum and at the same time increases the amount of water lifted. This pump in connection with an eight-foot improved steel aermotor will raise sufficient water to irrigate ten acres.

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L. W. Noyes, the president of the company, is the moving spirit in the establishment, directing personally every minute detail in this vast enterprise, employing nine hundred people and having forty branch houses. Four years ago with remarkable precision Mr. Noyes foresaw the coming popularity of the steel windmill. Acting upon his convictions he began the manufacture of a windmill in accordance with his ideas. From this small beginning has grown the large establishment of the present, and business is still increasing in such a rapid manner that another six-story building will soon be added to those already erected.

BOOKS AND MAGAZINES.

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By Theodore S. Van Dyke.

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well as the real hunt. To please such, a book should be made up of selected charms of the field."

Thus opens the preface to a pretty volume which—written with all of Mr. Van Dyke's facile but keen observation, and in his fluent, lucid, sparkling style—is one to fascinate not only the sportsman, but the nature-lover who never carries a gun or follows a dog.

Without being at all pretentious, this attractive little volume covers a great deal of ground, and, from its picturesque cover, throughout its well-printed, white laid pages to the end, it is a book of pleasure and a book of profit. To the sportsman these graphic narratives and valuable hints from a veteran field-shot must be of rare value, while no man, and perhaps even no woman, who loves the woods and fields and charms of animated nature, could fail to find genuine inspiration and much fresh knowledge of outdoor beauty from a reading of it. (New York: FORDS, HOWARD & HULBERT, Publishers. Clo., gt. top, $1.50.)

The Century.

MARION CRAWFORD is writing for *The Century Magazine* a series of papers on Rome and the Vatican for which Andre Castaigne is drawing the illustrations. These articles will describe unusual features of the Sacred City, and the pictures will include some remarkable restorations of classical scenes. Captain Alfred T. Mahan, the great naval tactician, will also write for the magazine a series of four studies of the naval engagements upon which the fame of Admiral Lord Nelson is founded. Henry M. Stanley will contribute a paper on Africa, to be supplemented by articles made up from the diary and journals of the late E. J. Glave, who died a few months ago on the Congo.

ST. NICHOLAS has secured a series of letters written by Robert Louis Stevenson to a boy relative, describing the author's romantic life in Samoa.

The Monthly Illustrator and Home and Country for October is literally packed with fine illustrations. Some of the more prominent of the subjects treated are Cuxhaven to Constantinople, the New Head of the Army, Lost Creek Literary Club, Mysteries of a Sultan's Palace, Jean Valjean, and many others. Published by the Monthly Illustrator Co., New York.

Review of Reviews.

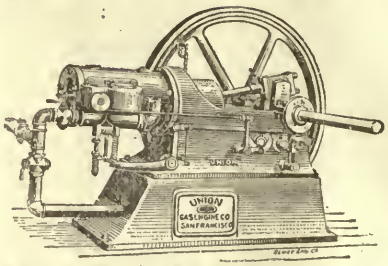
The October number of the Review of Reviews has as a frontispiece a good portrait of Sir Cecil Rhodes, Premier of Cape Colony and president of the British South Africa Company. The gigantic speculation in South African mines has drawn the attention of the world to this almost unknown country. This number of the Review devotes considerable space to foreign matters, some of the leading articles being Matabelaland under the British South African Company, the Maori of New Zealand, the Civil Service Problem in Australasia, and others.—*The Review of Reviews Co., New York.*

The Cosmopolitan.

The last of the Jungle Stories by Rudyard Kipling appears in the October Cosmopolitan. Among the other many good features in this number are Cuba's struggle for Freedom, The Greatness of Man, The Fortress of the Centuries and State Universities, The Cosmopolitan Irvington on the Hudson, New York.

After a man loses his ante he goes out in the world to find his uncle.

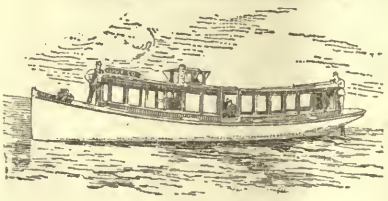
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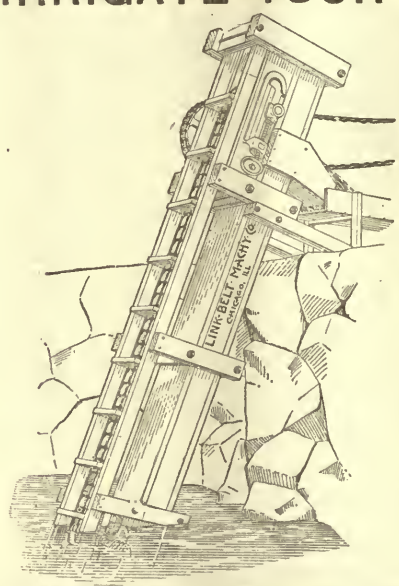
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THE IRRIGATION AGE.

VOL. VIII. CHICAGO, DECEMBER, 1895. NO. 8.

THE WRIGHT LAW IN CALIFORNIA.

BY F. C. FINKLE, MEM. AM. SOC. IRR. ENGINEERS.

THE Wright Irrigation District law has been in operation in the State of California since 1887, or for eight years. During that time there has been much progress under the act, and irrigation districts have constructed works and acquired water-rights for irrigation purposes to the approximate value of $20,000,000. Of course the success of irrigation districts has been variable; in some districts, where the management has been conservative and honest, the result has been that the property acquired is of much more value than the expenditure, and is of a character which insures its constant rise in value hereafter.

On the other hand there are a few instances of mismanagement, which has caused some loss, and the property of the districts so managed may not at the present time be fully worth the amount expended thereon. These instances, however, have not been due to defects in the law, but to other causes which no law could forestall. The only causes of partial failure or loss to districts have been the two following:

(1) The opposition of large landowners within the districts, who hold their lands for speculative purposes and do not possess the means or inclination to improve the same.

(2) The failure to sell the securities of the district for cash, so that it has been necessary to trade them off at a heavy discount.

The first of these causes has possibly been of more detriment to irrigation districts than any other, and has shown that it is unwise to include within the districts large holdings of a single individual. It would be impossible to prevent such inclusion by legislative enactment, however, as a law making distinctions of this kind would be class legislation and therefore unconstitutional. The only way in which the lands of large landowners objecting to being included in irrigation districts can be left out is not to propose them in the petition for the organization of the district. It therefore becomes a matter of policy with those proposing the organization of a district whether any one objecting shall be included or left out. For the good of the particular district being organized it is undoubtedly advisable to exclude all opposing parties, but for the public good they should be included, as it is without question the intent of the law to subserve the public good by reclaiming all the desert land in the State, in the same manner as the swamp lands were reclaimed under the reclamation act.

FOR THE PUBLIC GOOD.

The law itself can not be said to be unjust to any one, as there is no advantage given to one person over another by the law; it compels all alike to reclaim their lands from a desert state and make them productive. It is in this respect the same as other laws for making improvements in cities, towns, counties, reclamation districts, school districts, etc. In all such organizations it is a sad fact that there are people who oppose improvements, but when the public good demands their co-operation with the majority in making improvements, by which they will be benefited with the majority, the legislative power of the State is justly exercised in compelling them to do their share. The sole duty of people in irrigation districts is to see that the will of the majority is faithfully carried out, and that the funds from the sale of bonds or from tax levies are expended as provided by law, and the benefits to residents proportional to their assessments.

It is often argued by the enemies of districts that the benefits are not adequate to the expenditures incurred and that the payment of the taxes imposed is a burden too heavy to be borne by the property owners. When a statement like this is made the fact is overlooked that the value of lands in the districts is enhanced vastly more than the bonded indebtedness. To refute such a statement it is simply necessary to take the value of the land before it is supplied with water and while in its desert state and compare it with the values after it is supplied with water. In Southern California, for instance, what is unirrigated land worth? The best of it rarely is made to yield an income over and above State and County taxes of 25 cents per acre. And taking one year with another the net income will not average half of this. On the other hand, irrigated land has been known to yield as high as $1,300 per acre profit in a single year. But we do not claim that this is a fair average. It is not too much to say, however, that $100 per acre is a fair average for the income from well cultivated irrigated land in Southern California, after all expenses of cultivating and marketing crops are paid. This shows conclusively that irrigation benefits land greatly more than the amount of bonded debt under the Wright law in the most heavily bonded districts in Southern California.

Of course, if a person fails to improve and cultivate his land and avail himself of the water supply fur-

nishedby the district, he does not reap this benefit except in the future increase in the value of his land by reason of the improvements made around him, and the fact that he can obtain water whenever he decides to improve his land. This, not being a fixed annual income in money, the landowner is apt to overlook it and claim that he is paying taxes for nothing and without any benefit accruing to him. He never stops to reason that it is his own fault that he does not have a fixed income in dollars and cents from his property.

COMPARED WITH PRIVATE COMPANIES.

To take a practical illustration, the writer was in conversation not long since with a landowner who had not improved his land in an irrigation district near the city of San Bernardino but was compelled to pay taxes to the amount of about $1 per acre annually to the district for interest on bonds and incidental expenses of the district. This district is far enough advanced to be able to deliver water to all of its landowners if they want to use it, but this gentleman failed to consider this and claimed that the tax was without any consideration, and excessive even if he used the water. Then his attention was called to the fact that the amount was much less than was paid on stock annually in private water companies in the vicinity, and that the stock had to be purchased, and if money was borrowed on the land to buy the stock, interest had to be paid on the amount borrowed in addition to the assessments on the stock, which were simply for running expenses. The writer, as an illustration to him, showed him how *he* had paid to a company in the vicinity $90 per acre for water-stock for his land, and that ever since he had paid annual assessments to the amount of $3 per acre for the maintenance of the system and distribution of the water. In the district in question the bonded indebtedness for water was $18 per acre, and only two-thirds of this was outstanding, and the annual tax of $1 per acre was for interest on the outstanding bonds and all other expenses connected with operating the system of the district. The account of cost annually for water in this irrigation district and under the private system referred to would stand as follows:

In the irrigation district:

Interest on $12 per acre outstanding bonds at 6 per cent	$.72
Cost of maintenance and distribution of water per acre	.28
Total	$1.00

Under the private system:

Interest on $90 per acre invested in water-stock at 6 per cent	$6.40
Assessment as above for other expenses	3.00
Total	$9.40

This shows $8.40 per acre annually in favor of the district system in this instance, and the comparison is an absolutely fair one, as both water-rights are equally good, and the lands situated in the same neighborhood not more than seven miles apart. The only difference is that the tax for the district is levied on the land, and for the private water company on the water-stock. In either case it must be paid by the owner of the stock or the district water-right, whether the water is used or not. In addition, the private water-right herein quoted is one of the cheapest in the vicinity, and even if it is claimed that the district is an exceptionally good one the comparison is fair.

But it is urged by the opponents of the district system that often a tax must be paid while no water is as yet obtainable. This is true, but it is usually owing to the fact that every movement of the district has been fought and contested by the very persons making this objection, so that it is impossible to complete the works and fulfill the purposes for which the district has been organized. The taxes have been levied for legal expenses incurred in defending the organization of the district, which has never yet had an opportunity to do any development work. The failure to sell the district bonds has principally been due to the opposition made to districts by the class of landowners therein already referred to. There are, of course, other reasons why irrigation district bonds have not sold more readily, some of which are the following: Doubt as to the constitutionality of the law; want of faith in the managements; distrust of irrigation securities in general, and the hard times throughout the country and civilized world since the enactment of the law.

CALIFORNIA SUPREME COURT SUPPORTS THE LAW.

As to the first of these, the Supreme Court of the State of California has decided the law constitutional in the following cases: Central Irrigation District vs. R. DeLappe et al., Crall vs. Board of Directors of the Poso Irrigation District, and Board of Directors of the Modesto Irrigation District vs. Tregea, etc.

In support of the constitutionality of irrigation districts there was in addition the opinion of the United States Supreme Court in the case of Hagar vs. Reclamation District No. 108, and a number of decisions of the United States Supreme Court on statutes providing for the organization of various other kinds of districts in other States for making local public improvements. All these things had removed almost all doubt from the minds of attorneys and investors as to the constitutionality of the act, and it was universally conceded that there was but little doubt of the case of the Board of Directors of the Modesto Irrigation District vs. Tregea, before the United States Supreme Court on appeal, being decided in favor of the districts, and the constitutionality of the law sustained therein.

THE DECISION OF JUDGE ROSS.

The most eminent legal authorities did not hesitate to advise investments in district bonds, and very recently nearly a million dollars of bonds of the Poso and Turlock districts were sold to Chicago and New York capitalists on the opinion of Judge Dillon of New York, than whom there is no better authority on such questions. Hardly had this sale been consummated before a decision was rendered by Judge Ross in the United States District Court for the Southern District of California sustaining a demurrer in the case of Maria King Bradley et al., vs. The Fallbrook Irrigation District on the ground that the law providing for the organization of irrigation districts is contrary to the constitution of the United States. The fact that this was the first decision of a Federal court in relation to the act caused the greatest excitement and a practical suspension of all developments in irrigation districts and sale of bonds thereof. While the State courts could not recognize this decision, and irrigation districts are as constitutional as ever until the Supreme Court of the United States decides otherwise, still the effect of the Ross decision was to stop all progress in the various districts and to cause rejoicing among the enemies of the district system.

It has further resulted in a call being issued among residents of irrigation districts calling upon the people to subscribe towards a fund for the purpose of having this decision sustained by the United States Supreme Court. This latter movement was started by the old

enemies of the district system, but many new adherents to the movement have been secured on the representation that if the law be declared unconstitutional the people would still be the owners of the irrigation systems in their respective districts, but would be absolved from the obligation of paying for them. Without entering into the details of this question we will state that the opinion of the best lawyers does not bear out this representation, and it is generally held that the people whose money paid for the works will have an equitable lien on them, and that the people could only acquire a legal title to the district property by satisfying this lien. At any rate the bondholders would certainly contend for this in the courts, and the present subscription to have the Wright act declared unconstitutional will not be the only one which the people in irrigation districts will be called upon to pay, even if they are successful in having the act set aside, with the chances that they will gain nothing from all they have subscribed, as in any event they will have to pay for the property or give it up. If the property passes from them they will have a private corporation to deal with, from which they will either have to buy water-rights or rent them at a sufficient price to pay interest on the investment. In either case the people within the present irrigation districts will be the losers, as any one knows that a private water company can not furnish water as cheaply as an irrigation district. It is the same old question of a private water company in a city, or municipal ownership, only in another form, and this question is so well settled in favor of municipal ownership that it is no longer debatable.

POINTS RAISED IN THE DECISION.

However, let us look slightly into the grounds of the decision of Judge Ross and see the probability of its being sustained by the higher courts. In this decision the law was declared unconstitutional on two grounds: (1) On the ground that it sanctions the taking of private property for a purpose which is not public; and (2) On the ground that it provides for taking the property of a person without due process of law. Both of these are alleged to be features of the law and being contrary to the Fourteenth Amendment of the Constitution of the United States, the law is therefore declared unconstitutional.

The first question raised seems to be wholly dependent upon the judgment of the court as to whether irrigation is a public question and a public benefit, or whether it is a strictly private matter, with which the State and National governments have nothing to do, and the second is wholly a matter of law, as to whether the law in question contains provisions which are arbitrary, and therefore deprive a person of a hearing in regard to the taking of his property into the district or the subsequent taking of it for delinquent district taxes.

In discussing the probability as to whether the United States Supreme Court will agree with Judge Ross, or the Supreme Court of California, it is interesting to note the opinion in the case of Hager vs. Reclamation District No. 108, U. S. III, 701, which is a California case under the act for reclaiming swamp and overflowed lands. In this case the court decided that the reclamation of swamp land was a public benefit and not solely a thing benefiting the owner of the property. In view of this it is hard to see how the same court can decide that reclaiming a desert is any less a public benefit than reclaiming a swamp. Both are useless for agricultural purposes without being reclaimed and in each case is the cost of reclamation greater than can be borne by one individual. The private benefits are in either case the same, the property of individuals being greatly enhanced in value by the improvement, while on the other hand the benefits to the public are great. The taxable property of the State is increased, production and population are augmented, and commerce and immigration are promoted in the whole State, and the general health, prosperity and comfort of the whole people of the State are improved by the local improvements contemplated under either act.

It would be hard to say which is productive of the greater public benefits in the respects mentioned, the reclamation of swamp and overflowed lands or deserts, and it would seem that a court which has declared the improvement of the former a public benefit would have to reverse its own judgment in order to declare the latter of solely private benefit.

But irrigation is not only of public importance for the benefits which it can confer on the community where it is practiced, and on the State at large, but the safety of the public demands that it be exercised under government control in all respects. It is well known that the construction of irrigation works must be carried out in accordance with certain principles in order to insure the stability and safety of the works erected. Is the public interested in such stability and safety? If it is possible for irrigation works to fail and cause damage to the public I would say, yes. The failure of such works can, in more ways than one, concern the public safety. Not only does the property of that portion of the community depending on the system for water suffer by reason of such failures, but the giving way of dams or other structures erected for retaining and conserving large quantities of water may cause a widespread public calamity and great loss of life. The Wright District Law in California fully recognizes the importance of this public phase of the question and directs that works of this character shall be designed by a competent civil engineer employed by the board of directors for that purpose.

Judge Ross, in his decision against the constitutionality of the law, argues that because the same provides for the distribution of the water acquired by the districts for irrigation purposes to the landowners within the districts and not to the whole public therein, the purpose of the act cannot be considered a public one. The distribution of the water for irrigation is only the means to an end; namely, thereby the desert land is reclaimed and made productive in the same way as the draining of swamp land is only the means by which it is reclaimed. A law providing for distribution of water to all living within a certain territory, irrespective of whether they are contributors to the revenues and can be benefited by the use of the water, would be a miscarriage of the purposes of the law and would not result in the reclaiming of the desert land sought to be reclaimed, and would therefore fall far short of being a public benefit. On the other hand, the apportioning of the water to the taxpayers (only real estate and improvements in an irrigation district are taxable) in proportion to the taxes they pay, fulfills all the requirements of a law for local public improvements; namely, that benefits must, as nearly as possible, be apportioned according to contributions exacted and the benefits must also actually result from the means provided to accomplish them. What benefit could be accomplished to the public by distributing water for irrigation to those who can not use it for the purpose of reclaiming the desert land in the district? The public benefit sought

by the irrigation system is the reclaiming of desert land. From this is expected to flow other benefits, in which the public at large has an equal share.

IRRIGATION POLICY IN FOREIGN COUNTRIES.

But let us see what is the custom of all civilized countries, where irrigation is practiced, in regarding the benefits therefrom as public or private, or the question as one concerning the State or private individuals merely. Let us examine the policy of France, Italy and Spain. In each of these is irrigation regarded as a public question and the benefits derived therefrom as strictly public benefits. As a consequence these governments have in every possible manner promoted the development of irrigation systems by passing irrigation laws, granting concessions to promoters of works, allowing communities to associate themselves together for the same purpose, allowing municipalities, provinces and States to construct works, authorizing the general government to construct works with public moneys, etc. Every one is familiar with the irrigation policy of the English Government in India. In fact we fail to find a country where irrigation is not regarded as a matter of great public concern and benefit, if regarded at all.

The question of irrigation is essentially a public one and is recognized as such the world over even to a greater extent than the drainage and reclamation of swamp lands. Now in the absence of a declaration in the Constitution of the United States that it shall be a private matter in this country, we must regard it as public, this being the opinion and policy of the whole civilized world, based on logic, custom and written laws. In the face of this can we doubt that the United States Supreme Court will sustain the district law in California? It has already sustained the reclamation district law, and which is of the greater public importance to the people of California, the reclaiming of desert land or of swamp land? Every one knows that for every acre of swamp land to be reclaimed there are thousands of acres of desert lands. In fact the future wealth and prosperity of California as a State must come from the irrigation of its great deserts.

METHOD OF ORGANIZING DISTRICTS.

The next question is, does the Wright Irrigation District Law authorize the taking of property of a person without the due process of law? The law provides for the presentation of a petition to the Board of Supervisors of the county where the greater portion of the land sought to be formed into an irrigation district is situated. The board must give notice of a hearing and conduct the same at the time and place designated. There is no restriction as to who may be heard. Every one having a grievance can be heard and the only restriction placed upon the board is that "upon the final hearing they may make such changes in the proposed boundaries as they may deem proper, and shall establish and define such boundaries; *Provided*, That said board shall not modify said boundaries so as to except from the operation of this act any territory within the boundaries of the district proposed by said petitioners which is susceptible of irrigation by the same system of works applicable to the other lands in such proposed district; nor shall any land which will not, in the judgment of said board, be benefited by irrigation by said system be included within such districts. *Provided*, That any person whose lands are susceptible of irrigation from the same source may, in the discretion of the board, upon application of the owner to said board, have such lands included in such district." There is nothing forbidding a hearing to any one on any question involving the sufficiency of the petition, the right to include any land or exclude any other, the question as to whether any of the land included will be benefited by irrigation or requires irrigation, or on any other question touching the point at issue. But upon a final hearing if the board shall find that the law has been complied with and that it has jurisdiction of the matter it shall define the boundaries of the district in the manner provided, which it must be conceded is in every way an equitable one. The board can not make fish of one and fowl of another, that is all.

There is nothing forbidding an appeal to the Superior Court, from the determination of the Board of Supervisors and there is every opportunity for the person whose land is sought to be taken into the district to be heard as to his rights at the proper time. Further, there is a provision for a confirmation of the proceedings in the Superior Court, at which any one interested may appear and contend for his rights, and the fact that the district does not have to seek a confirmation is no objection, as any one interested may at any time attack a district before the confirmation proceeding has been begun and the district may pray for a confirmation in its defense of such proceeding begun against it. In the assessment of property and collection of taxes it is the same.

There is opportunity to be heard on every point and a "due process of law" is observed throughout. A perusal of the law will reveal the fact that the use of the courts and rights accorded to the people by the laws of the State is preserved to them throughout. If any one is treated unjustly and does not have his day in court, it is because he sleeps on his rights and not because there is any effort to wrest his property from him without "due process of law."



UTAH PRODUCTS.
Grown by irrigation along the line of the Rio Grande Western Ry.

ATMOSPHERIC IRRIGATION.

BY WILLIAM REECE.

IN discussing this subject let us first consider the cause of the arid condition of our country. In the equatorial region, at a high altitude the air acquires a rapid eastward motion, and on account of the more rapid eastward motion of the air there than in the temperate regions, the principal part of the air from the Gulf of Mexico passes ordinarily toward the northeast and waters the great Mississippi valley. The air that comes from the Pacific ocean necessarily crosses the mountains and in so doing loses a considerable portion of its moisture.

In the summer the land is much warmer than the water because in the evaporation of water much heat becomes insensible or latent. This may be illustrated as follows: Plunge the bulb of a thermometer into boiling water and note the temperature. Then hold the bulb in the steam over the boiling water and the temperature of the steam will be found the same as that of the water, yet it is well known that steam can give off much more heat than water at the same temperature.

It is also well known that the humidity of the atmosphere varies with its temperature. To illustrate this, select a cool room, as nearly airtight as possible and in the room boil water until the water is running down the walls and windows, and dry clothing hung in the room readily becomes damp. Then remove the water and raise the temperature of the room. The wet windows, walls and clothing will become dry and green cornstalks or any growing plants placed in the room will (unless the roots are well supplied with moisture) dry up the same as in the hot winds. There is just as much moisture in the air of the room when the clothing readily dries as when it readily dampens, but at a high temperature the air has a capacity for holding great quantities of moisture in an invisible or latent condition.

There is nothing mysterious about the hot, withering winds of the plains. Nearly every State in the Union has at times hot, drying winds, but where the heating and drying basins are small, the damage to crops is slight. I have experienced hotter winds in Ohio than I ever felt on the plains in western Texas, Kansas or Nebraska; but the hot winds in Ohio came in short puffs, because the heating surfaces were small.

Let us place observers at three-hour points, in a line from the mouth of the Rio Grande to the north line of Nebraska.

To the observer at the mouth of the Rio Grande at 6 a. m. the south wind is cool and refreshing; to the second observer at 9 a. m. the wind is still pleasant but warmer and drier. The third observer at noon finds the air much warmer and much drier. The fourth observer at 3 p. m. finds the air hot and dry. At 6 p. m. the air is still warm and dry. The sixth observer at 9 p. m. finds the air much cooler. The observers at midnight, 3 a. m., and 6 a. m., find the wind cool, moist and invigorating. To the tenth observer the same current of air is again warm and dry. At stations 11 and 12 the wind is hot and dry. It has become a furious, thirsty monster, sucking the life-blood from every living thing.

Every man who has lived in these hot winds well knows that his only safety is in drinking a great deal of water. On severe days, he puts at least two gallons of water into his stomach every twenty-four hours and the thirsty wind sucks it from his surface pores. In like manner the successful farmer supplies as much water to the roots of his crop as the hot winds can take from the branches. Follow this wind farther north and we find it each *day* a fierce, thirsty destroyer and at *night* an invigorating supporter of animal and vegetable life.

On the plains are many thousands of square miles of unbroken, impervious and heat-reflecting mesquite, gramma, and buffalo sod. These plains become a great dry-kiln and the air cannot pass over it in any direction without having its capacity for moisture greatly increased.

Plenty of water falls on the plains, but the unbroken ground is hard; the tough sod is almost impervious and the water rushes through draws and channels out of the country and in three hours of sunshine the ground is about as dry as it was before the rain. It seems incredible, yet it is true and settlers will verify the statement, hat out on these dry plains teams and drivers have been drowned in draws where an hour afterward another teamster could not find enough water to quench the thirst of himself and horses. During the past summer, with the exception of a belt through central Nebraska and Kansas, there were heavy rains all the way from Falls City, Neb., to Cindad Juarez, Mexico. This rain did much damage to the crops in some parts of Colorado and New Mexico.

It has often been stated by experts that but about 30 per cent of western Nebraska and Kansas can be irrigated. We see no reason why *all* the land can not be made to produce good crops if the dry winds be allowed to slake their thirst by drinking water instead of the sap of growing crops.

The country in many places is too wild for agriculture and must be tamed. 'Tis true the Indian, buffalo and desperado are gone, but the farmers' worst enemies are the wild grasses, and the wilder prairie fires that remain to drive the lonely farmer from the plains. The plowing under of all the wild, tough and impervious sod will prevent prairie fires and will cause most of the rainfall to be retained in the soil. The ground should be plowed deep and alfalfa and other tame grasses used for pasture.

Every farmer can construct retaining-walls across the narrow necks of feeding draws on every quarter section. If the ground be gravelly, straw, fodder, etc., can be hauled in and cattle and hogs fed in the basin. It will soon become as a buffalo wallow and will hold water very well. On high ground basins can be made and treated in a similar manner, and the basins can be filled by pumps bringing the water from wells, rivers or lower reservoirs. The lower reservoirs can be filled with flood waters.

Two gray-bearded veterans of the plains told me that my ideas of irrigation were all visionary. They said wherever tried it was a failure. I asked them if

they had visited any of the irrigated districts in Kansas, Nebraska or Colorado.

Their answer was, "No;" they did not have any faith in it. They had tried to irrigate their cornfields but could not get the water a hundred yards from their pumps. Upon further inquiry I learned that their pumps were about an inch and a quarter in diameter, that they had no reservoirs, never let the pumps run except when watering stock, until in summer when their corn was withering, they would start the pumps and try to run an inch stream of water out over the hot, dry ground. People like these will oppose every enterprise in this direction.

If individuals, communities, townships, counties, States and the general government will articulate action in this direction, soon great quantities of the flood waters will be stored upon the plains. The lower Mississippi can then be kept within bounds without the annual expense of millions of dollars for sandbags, rip-rap, etc.

There are thousands of places where the overflow waters of the upper Concho, Colorado, Brazos, Wichita, Pease, Red, Canadian, Cimaron, Arkansas, Smoky, Saline, Solomon, Republican, Platte, Rattlesnake, Niobrara and Missouri rivers can be stored with moderate expense, and we believe that it is the duty of our Congressmen to press this matter until some definite action is taken other than appointing a committee to ride in sleeping cars to the Pacific over one route and return over another.

The reservoirs, large and small, should be stocked with food fish, and be surrounded with fruit and forest trees. *All* the ground should be thoroughly cultivated, no vegetable matter ever be burned except in the stove, and for several years no grass sown except alfalfa. In order to reach this high state of cultivation the farms must be small.

Any family can have abundance and much to sell from forty acres under good cultivation. If people want homes, forty or eighty acres will be enough, but if they wish to engage in shipping and speculating in grain, it will be better for the country if they do not own any land.

Pumps should be from four to ten inches in diameter, and be allowed to run day and night, winter and summer. When one reservoir is full, flood the ground or fill another reservoir. Long and deep furrows can be plowed on the high ground to collect the winter snow and rain. As soon as you have enough water, thoroughly soak the ground, whether it be fall, winter, spring or summer. In many places along the river, side pits can be dug, and siphons, chain-buckets, pumps or Archimedes' screws be used.

Every acre irrigated will diminish the necessity for irrigating the adjoining acres. Let us briefly consider the effect of the conditions named: As the air moves along it will pass over water and over land. The water will be evaporated, and every drop of water taken up in the form of vapor into the air will lower the temperature of the air, as can easily be noticed by sprinkling the floor, porch or yard in hot weather, or by standing on the windward side of any lake or river. Also in the summer when it rains a few miles from you, the wind from that section is cool so long as the water is evaporating.

As the temperature of the air is lowered, its capacity for taking moisture out of plants is diminished. It is therefore rendered harmless even when passing over the hills where water can not be applied. The weight of the atmosphere is also increased by the hundreds of tons of water taken up and its velocity retarded by its increased weight, by local conflicting currents, and by the numerous groves, orchards, buildings, etc. As an explanation of the local conflicting currents it is enough to say that the air that rests on the water becomes cooler and heavier than the air that rests on the land. This in the daytime at least will cause outward currents from all the large bodies of water.

The hope of this country is in atmospheric irrigation. With our country well plowed, subsoiled and cultivated, and water stored along the plains, the air could not acquire a damaging thirst for water, and good crops could be raised on hill and valley in nearly all parts of our country without any artificial watering of the ground. Even now, with one hundred acres in buffalo sod to one under cultivation, fair crops could be raised in most parts of the country nearly every year without watering the ground, were it not for the thirsty winds.

In one of the '80s, on the fourth day of July, the corn everywhere was healthy and growing rapidly. Three days later the corn all over central and western Kansas was dead. The wind then changed, rain fell and the remainder of the year was seasonable, but the damage had been done. The corn crop was a total failure. This is almost an annual experience on the plains. Whether the hot winds come in the spring, summer or fall, all that they are greedy for is water, and they demand that only in the daytime.

The more we irrigate the less we need to irrigate. If reservoirs be placed well south and along the plains the air will not acquire much thirst and the little that may be acquired will readily be satisfied by the water in numerous reservoirs. As the rainfall would thus be kept in the country, the quantity from this source would annually increase. To this surplus would be added the great amount brought to the surface by pumps and led out from the rivers by ditches. This would furnish sufficient moisture for the crops, and the increased evaporation from reservoirs, earth, crops and groves would undoubtedly cause local showers.

For our rainfall now we are indebted to the cyclonic winds that bring us moisture from the Gulf of Mexico and to the friendly mountain breeze that lowers the temperature to the point of saturation, but we are probably more indebted to the grand old Pacific that slops over the continental divide and sends streams of pure water through our arid plains and a shallow ocean of water beneath our feet.

After eighteen years spent in scientific work in the laboratory and one and one-half years spent as geologist on the plains, from the Concho valley to the north line of Kansas, I commenced in 1886 to work up the subject of atmospheric irrigation. In seventy-five articles written since that time I have urged the same thing, and I offer this communication in the hope that it may help a little in the study of these great fertile plains, destined and reserved, as I believe, for the scene of the grandest triumphs of art and science, where, with small farms and intelligent, happy citizens, the advantages of both city and country life will be happily blended. Industry, frugality, intelligence, independence and contentment will characterize the people; the music of church and school bells and the song, "Home, Sweet Home," will be heard from home to home, from church to church, and from school to school throughout the length and breadth of this great fertile belt.

The population of the United States is increasing about a million a year, and the rising generations must have homes or be homeless tramps and pests. We must be a nation of citizens or a nation of dissatisfied, turbulent paupers.

IRRIGATION IN TEXAS.

UTILIZING THE SMALLER RIVERS—POSSIBILITIES OF ALLIED INDUSTRIES.

By F. H. NEWELL.

In regard to irrigation by means of storm water, I must confess that after seven years of active service in various matters pertaining to irrigation investigation and the measurement of water resources of the country in all the States and Territories of the West, I am still far from confident as to the present practicability in *general* of this method of development. As conditions now are, there are so many localities where irrigation can be successfully conducted by cheaper and more reliable means, that it is only in comparatively exceptional cases that irrigation by stored water can be practiced with profit. Some of these exceptional cases are to be found in your own State, where, with favorable topography for delivering and holding storm water at points where dams can be cheaply constructed, it becomes feasible to hold large quantities each year. Each of these cases, however, must be carefully considered upon its own peculiar merits, and no generalization can have much value in determining upon a course of procedure.

In the progress of the systematic topographic mapping of Texas, now being conducted by this Survey, and in the examinations made by other parties, many of these reservoir sites are being discovered, and their existence should be made known at the earliest possible date to the public, in order that suitable steps may be taken to ascertain the exact cost and benefit of water storage at each point, and that the question of ultimate profits may be fully and carefully discussed. During the existence of the irrigation branch of this Survey a considerable number of reservoir sites in different parts of the country were carefully surveyed, the cost of dam construction under various conditions ascertained, and the area of land to be benefited estimated from the topographic sheets. A few of these works have been constructed by private parties, but by far the greater number are still considered as matters for the future, when irrigated lands and crops will have a greater local value following upon increase of population. There are, as above stated, too many opportunities for the development of agriculture by irrigation by cheaper means. This is the point upon which I would dwell in this brief paper.

There is one thing which the people of Texas need to keep constantly before their eyes, and that is the possibilities of building up an innumerable variety of small industries, these in the aggregate contributing far more to the permanent prosperity than the great enterprises usually discussed. This is true, not only in manufacturing and in ordinary farming, but is especially notable in irrigation. Few people appreciate the great advantages possessed by Texas in this line, through the fact of the relatively wide distribution of small perennial sources of water in the form of springs and creeks, deriving a constant supply from seepage. There is hardly a State in the West in which the water supply, such as it is, is so broadly distributed in bodies, each one of which can be easily controlled by a few farmers.

In looking over the statistics of irrigation, one of the most striking facts is that the notable successes and the rapid increases of wealth to a community have come *not* through large enterprises in irrigation, but through the construction by the farmers themselves of moderate size ditches leading from streams whose volume is small and whose fluctuations, especially during the summer time, are within narrow limits. These are the men who have built for themselves comfortable homes, who have reclaimed arid land and given it the highest value to which farming land can attain. They have, by concerted effort and the use of relatively insignificant capital, year by year extended the ditch systems and by personal management have kept the expenditures for annual maintenance at the minimum. It is to the predominence of these in the Census Report for 1890 that is due the relatively low average first cost and annual expense of irrigation. Throughout the greater portion of the arid and semi-arid regions the opportunities for such development no longer exist. The choice spots have been picked, and there only remain the larger, less readily controlled sources of water or opportunities for storage.

Texas, however, is exceptional. Irrigation development has not proceeded rapidly, except in a few spots in the more arid western part of the State. The opportunities for a great number of small enterprises are still open.

In sharp contrast to the development of irrigation in a small way are the great enterprises, involving heavy capitalization, and as an incident evil, the manipulation of stocks and bonds. Taking the country through, nearly all of the great corporations which have constructed extensive irrigation works are verging upon bankruptcy, if not already in the hands of receivers. In the main the difficulty of settling a desirable class of farmers upon the lands under these great systems, the slowness with which agriculture develops, and the length of time required to acquire experience in the handling of waters, has so retarded the income of these companies that the cost of maintenance and interest charges have eaten up the reserve capital. As a result, the works have often been badly managed, adding further to the discouragement of the settlers under the great canals. These corporations or great companies are necessary to handle comprehensive systems, unless the State or Nation will do it, and in the future must probably multiply in number; but in the State of Texas at present, it appears that the first and best development, and the one leading to the most good, will be through the utilization of springs and creeks by associations composed wholly of irrigators.

The investigations being conducted by this Survey have not proceeded sufficiently far to enable me to discuss with any degree of assurance the volume and fluctuations of the many important, though small, streams of the State. To an engineer who has traveled through the various portions of the United States where irrigation is practiced, the striking opportunities of Texas along the beautiful, well-watered valleys, where the marvelous springs, especially of the central part of the State occur, it becomes evident at a glance that a great increase of population is possible when comprehension is had of the possibilities of employing this water upon the lands usually too dry for the best success.

It must not be supposed that irrigation is alone valuable in the arid or semi-arid portions of the State. Perhaps the greatest benefit will come through the construction of irrigation works, not with the intention of using them at all times, but rather as an insurance against the deleterious effect of occasional droughts. In many parts of the State deemed humid there are soils of great fertility in which during perhaps only a few weeks of the year, the supply of moisture becomes reduced a trifle below the needs of the plants, bringing down the average production and value of the crop just enough so that it will not rank as first-class. Water applied at the right time in such cases will bring the crop from a condition below the average up to the highest yield with the difference between bare profits and large returns.



AN IRRIGATION CANAL IN UTAH.

ALL KANSAS NOT TO BE IRRIGATED.

BY F. D. COBURN, SECRETARY STATE BOARD OF AGRICULTURE.

IT is a curious circumstance that when irrigation in Kansas is talked about in the presence of people who have not given some attention to the subject, they directly or indirectly betray the fact that their only idea of the subject is that irrigation implies having sufficient water and pouring it over unlimited areas of field and pasture at will. From this standpoint they are at once prepared to argue, and quite properly too, that irrigation will not and cannot be practicable, because even if there is sufficient water under ground (and they think the supply quite insignificant) it would be a physical impossibility to make it available for any more than wetting perhaps an occasional "garden patch."

The facts so far as known are something like this: Nobody wants to irrigate all Kansas, nor all of any county of Kansas; indeed, not even the wildest enthusiast who has the least familiarity with the situation ever suggests the irrigation, in its best development, of more than a minor percentage of any county. It would not be done, nor is it known that it would be advisable, even if the water for it was standing in reservoirs and streams constantly ready for use.

So far as known there is, exclusive of streams, an inexhaustible supply of underground water ready for those who will reach for and use it, up to whatever limits they set for themselves. All the evidence obtained up to this time bears this out, and there has been none in rebuttal.

The soil in those portions of Kansas proposed to be irrigated is demonstrated beyond question to be fertile and productive past any limits yet ascertained, when properly tilled and seasonably touched with water.

Having found out these things, the owners of those lands intend to use their brains in bringing some of this life-giving water into their service, and spreading it out, along with the storm waters they will save, over enough of their soil to produce crops; on a very modest scale at the start, to be sure, but it means a maintenance from the very first and will mean much more as developments follow. The other portions of their farms will be no less available than before for whatever crops are deemed best to plant, and especially those found adapted to "dry farming" in such localities, and likewise for an improved stock-raising under highly favorable conditions. With the water so near at hand, inexpensive devices for placing it in surface reservoirs or in a deeply stirred subsoil will be worked out by good American brains, and the tireless winds that have before had so much to do with carrying away our moisture are likely to be harnessed to machinery and made to do a mighty work of atonement in making fruitful these great plains.

THE FORESTS OF WASHINGTON.

BY MRS. ALICE HOUGHTON.

This is the forest primeval. The murmuring pine and the hemlock,
Bearded with moss and in garments green, indistinct in the twilight,
Stand like Druids of old, with voices sad and prophetic,—
Stand like Harper's hoar, with beards that rest on their bosoms.
Loud from its rocky caverns the deep-voiced neighboring ocean
Speaks, and in accents disconsolate answers the wail of the forest."—*Evangeline.*

LONGFELLOW shows in these lines an intimate knowledge of nature that amounts almost to divine intuition. His keen appreciation unrolls before us a grand panorama of forests, with tall hemlocks and waving pines, towering like great cathedral spires above the "rocky caverns," their leaf-woven domes nodding and swaying in the breeze, until they seem like human souls pluming for flight to heaven in search of the mysteries of the vast infinite.

One can fancy the author having been transported to the great Washington forests and to have drawn his inspiration from the wealth of timber that possesses that country. What a wonderful growth of forestry is here—nearly 24,000,000 acres of the finest timber in the world. On Puget sound trees grow 275 feet high and average in diameter from twelve to twenty feet. The leading varieties are fir, spruce, cedar, tamarack, pine, alder, maple, ash, larch, cottonwood, yew and oak. There are other varieties but this list comprises about all that are found in large bodies. The best timber does not grow directly along the coast but begins a few miles back and becomes larger in size as it reaches the base of the Cascade mountains, diminishing as it creeps to the summit, increasing again as the descent is made on the eastern slope.

The timber of Washington is pretty equally divided between the eastern and western portions of the State. The density, however, is largely in favor of Puget sound, owing to a lesser acreage of land. The divisional line is the Cascade range of mountains, and from that point to the eastern boundary of the State it is 300 miles, while from the Cascades to the western boundary it is only 100 miles. Yellow and red fir, known as the Oregon fir, is in great demand for ship timbers and bridging, owing to its strength, flexibility, lightness, tenacity and evenness of fiber and nail-holding qualities, and its freedom from knots and defects. The world is drawing its supplies of masts and ship spars from there. Some of these woods are especially adapted for sounding boards of pianos, the trees being sufficiently large to cut them all in one piece, and thus avoid splicing. They are used as well for violins, guitars and other musical instruments, and such instruments are found to be superior, both in quality and tone. Spruce and larch are very large trees and, with the maple and oaks, furnish beautiful stuff for furniture and ornamental work.

It is estimated that the total number of standing feet is 500,000,000,000 and its valuation amounts to $300,000,000. More than one-half the lumber and shingles cut in Washington is shipped to foreign points and eastern markets. In 1893 ships carried cargoes to thirty different countries, from Australia, in the far South, to England, in the far North. Transportation facilities are excellent, water being plentiful, while the railroad accommodations are ample and complete. In time shipbuilding is sure to become a great industry in that State. The bark obtained from the hemlock trees is estimated to be from 10 to 15 per cent stronger in tanning properties than the eastern barks and is better and more desirable in color, and tanneries can be made to pay well. Not less than one-third of the population of Washington are dependent for their support upon the saw and shingle mills, sash, door and blind factories and other woodworking establishments. The yearly capacity of those mills amounts to 7,000,000,000 feet.

It is among the workers in these saw-mills that the farmers find a ready market for great quantities of their agricultural products. With the increase of sawmills will come an increasing demand for vegetables and fruits.

Ah! these wonderful forests, with their impenetrable depths, rising like "pillared colonnades" above the surrounding country and guarding it with the vigilance of an army. They even challenge the sun to reach their mysterious realms. Although he glints and shifts and coquettes with them daily, he rarely obtains more than a passing glimpse of the waving branches high up at the top.

POWER OF SOILS TO RESIST EROSION BY WATER.

BY WM. A. BURR, C. E.

THERE are two classes of matter composing all soils, organic and inorganic, the former composed of decomposed animal and vegetable matter, always in undisturbed soils, found at the surface and known as humus and the latter composed of variable proportions of sand, clay, and soluble salts.

The organic matter is always lighter than water and will consequently float away when in contact with water and therefore have absolutely no value for structures in contact with water, and as the soluble salts will, as their adjective indicates, dissolve, neither will they have any value.

We have left then the sand and the clay, both of which being heavier than water, we must look to them alone for value in earthen structures, water weighing, say 62½ pounds per cubic foot, sand weighing 101 pounds per cubic foot, and clay weighing 119 pounds per cubic foot.

Now as clay is heavier than sand, consequently the larger the proportion of clay to that of sand the greater will be the power of the soil to resist any hydraulic force, be it pressure due to head or depth, or erosion due to velocity.

It has been the custom among engineers to use the

classification of soils given in agricultural chemistry, although I question much if the use of the classification originated through a study of that very useful branch of science, but rather by absorption from our friends the farmers.

Agricultural chemistry informs us that soils carrying from 75 to 100 per cent sand and 0 to 25 per cent clay is a sandy soil, and that sandy loams carry from 25 to 60 per cent clay and 40 to 75 per cent sand, loamy soils 60 to 75 per cent clay and 25 to 40 per cent sand, clay loams from 75 to 90 per cent clay and 10 to 25 per cent sand, and agricultural clay 90 to 100 per cent clay and 0 to 10 per cent sand.

This classification, while correct for the purposes intended, and the farmer can tell to a nicety whether corn will thrive on a sandy loam, or whether it requires a clay soil, is misleading in the extreme as applied in engineering. Take for example sandy loams which have a range of 35 per cent. We find by one engineer that he has constructed a canal through a sandy loam which had only a velocity of 1½ feet per second and yet eroded; while another informs us that he has run water through sandy loams at a velocity of 2.75 feet per second without erosion, while the average seems to be 2½ feet per second.

As I have shown, and, no doubt, the practice of many other engineers has shown them, the value of a soil for hydraulic purposes depends entirely upon the proportions of sand and clay carried by that soil; that being the case I contend that soils should be designated by symbols representing those proportions; for example, if a soil carries 80 per cent clay and 20 per cent sand, it should be described as C. 80, S. 20 and so on.

The analysis of soils to determine these proportions is very simple and may be performed in the office of any engineer. The organic matter is first removed by burning in an open flame the soil which it is desired to test, and the soluble salts are dissolved by placing the burnt soil, stirring briskly, in a glass graduate filled with water. The sand and clay will settle in the bottom of the graduate in two stratæ, the clay at the bottom and the sand on top, the soluble salts remaining in suspension. By the difference in color the sand and clay are readily distinguishable and by the graduations on the glass the proportions may be readily arrived at.

The following table, based upon a series of experiments from 1889 to 1893, and upon the foregoing theory, may be of use and may explain some of the wide differences of opinion as to the power of soils to resist erosion by water. The value of clay for puddling purposes has long been recognized and I contend that it is equally applicable in the case of velocity. (See Engineering News, Feb. 8, 1894, page 124.)

TABLE SHOWING RESISTANCE OF SOILS TO EROSION.

Old Classification	Sandy Soils.		Sandy Loams.			Loamy Soils.			Clay Loams.		Agricultural Clay.
Soil.....	c-000 s-100	c-10 s-90	c-20 s-80	c-30 s-70	c-40 s-60	c-50 s-50	c-60 s-140	c-70 s-30	c-80 s-20	c-90 s-10	c-100 s-000
Safe velocity in ft. per second	1.10	1.15	1.28	1.47	1.75	2.15	2.70	3.35	4.20	5.40	7.35



A RANCH ON THE LARAMIE RIVER IN WYOMING, NEAR ORIN JUNCTION.

COLONIAL LIFE FOR THE COMMON PEOPLE.

BY OLIVER N. GOLDSMITH.

IN times past, it has been thought that people of moderate means occupied the social plane the conditions of which were most conducive to contentment and happiness. "Give me neither poverty nor riches," was the exclamation of Solomon, who was noted for his wisdom. To have enough to supply all needed comforts and to ward off the fear of possible want, and at the same time to be free from the responsibilities, temptations and care of great riches, should, independent of other mental, moral or physical conditions, be the estate of a happy man.

But the time seems to have come when, in our large cities, men with small capital are put to a disadvantage in their attempts to compete with the power of great concerns having unlimited resources. The small merchant who once was prosperous, enjoying his share of the general trade, finds it impossible to compete with the great department stores that can underbuy and undersell him in every line of goods handled; and the plants of the small manufacturers have been absorbed by the great corporations that command millions. Some of the men who were formerly in business for themselves are now floor-walkers, managers or employes in some capacity of their great competitors; while with others the great problem of getting employment of any kind has been and is now causing them great concern. Never were there such struggles for political office as have been made during the last few years by men whose accumulations were melting away, while they have seen no encouragement to engage in business. The uncertainty of continued employment felt by those fortunate enough to find salaried positions makes their life but little to be envied by the less fortunate seekers for employment.

A bill was proposed in the Illinois Legislature last winter designed to check the growth of department stores, and make it possible for a great number to prosper in trade. But the success of such legislation, if attempted, is doubtful. The problem is not to be solved in that way. The great currents of trade hew out channels for themselves, and it seems impossible for legislative bodies to pass laws to effectively check or control them. The great structure of trade is becoming topheavy, the professions overcrowded, debts repudiated and credit destroyed. These conditions exist in the greatest degree in our large cities, because they are the great marts of trade and the evils of abnormal and unhealthy tendencies are there felt most acutely. And no relief can be expected so long as the abnormal growth continues. What is the remedy? The answer suggests itself—the people must scatter.

"And Abram said unto Lot, let there be no strife, I pray thee, between me and thee and between my herdmen and thy herdmen. Is not the whole land before thee? Separate thyself, I pray thee, from me. If thou wilt take the left hand, then I will go to the right: or if thou depart to the right hand, then I will go to the left."

Abram never lived in a large city like Chicago or New York, but he enunciated a great principle in political economy equally applicable to the people of those overcrowded cities. "Is not the whole land before thee?" It has been stated that the western half of the United States is capable of supporting a larger population than the eastern half. Millions of acres of rich soil need only to be irrigated to be made wonderfully productive. Why should not many of us secure homes upon these irrigated lands? By raising first a variety of food supplies necessary for the consumption of the family, we secure our industrial and individual independence, and the living which is here uncertain and precarious is assured.

But some will say, "There is now overproduction in agricultural products, and there are no markets at paying prices." The relief for this condition has been pointed out again and again. Let the farmer diversify his crops. He should so manage his farm as to obtain from it a supply of what his family needs for its support—vegetables, fruit, chickens, eggs, milk, butter and meats. To that extent he will always have a home market, with no profits to middle men. Then if a surplus of dairy products be raised, it is difficult to conceive of a locality where there is not a market for them at paying prices.

Lands cultivated in fruit are highly profitable, and the consumption of fruit can be greatly increased and the market for it extended by such efforts as are being made, and will be made within the coming years, to reach hundreds of small cities with carload lots, that have heretofore been considered impossible markets. It is now known that they are better and more profitable markets than the large cities. As the amount of land adapted to fruit culture is limited, there is not likely ever to be overproduction of fruit in this country.

To make it possible and easy for many people to leave the crowded cities and occupy the land which is waiting for them, the formation of colonies should be recommended and encouraged. A large company of colonists locating together upon new land have, almost at the outset, all the social and other advantages of old settled communities. There is the encouragement and enthusiasm of a common purpose and its execution, and the home built and the farm brought under cultivation by each and every colonist benefit not only himself but all the rest. Besides, valuable and attractive features may be thought out and adopted for the general benefit of the colony scheme. For example, Plymouth colony in the Payette valley, Idaho, has a central village beautifully laid out with parks and boulevards, and in addition to his twenty-acre farm, each colonist has an acre lot in the village on which he can build his home and live with all the surroundings of village social life. This colony invites people from the overcrowded cities to take up farms and build homes in the "New Plymouth." Fruit culture, diversified farming and dairying can all be made highly profitable. The water for irrigation is from the Payette river, a never-failing supply, and a large canal is built and fully equipped to irrigate the land.

This colony has been referred to because it has been happily planned to meet and overcome the objections to ordinary farm life, and to demonstrate the possibility of successful change of home from city to rural surroundings without incurring the hardships commonly thought to be incident to such change. Other colonies should be formed. The arid lands of the great West should be made, by irrigation, to contribute to the support of America's population, and as progress is made in this direction, the sage-brush plains will blossom into orchards and farms, surrounding happy and prosperous homes.

THE DIVERSIFIED FARM.

In diversified farming by irrigation lies the salvation of agriculture.

Short, practical articles, notes of experience and observation, are invited from the readers of THE IRRIGATION AGE who are interested in the promotion of the idea of the small diversified farm, providing to the fullest economical extent all of the various articles of food, clothing, etc., required by the family.

SETTING OUT FRUIT TREES FOR IRRIGATION.

BY F. C. BARKER OF NEW MEXICO.

WRITERS upon the subject of the distances at which fruit trees should be planted never seem to take into consideration that it makes a great deal of difference whether the trees are to be irrigated or not. Take for instance the case of peach trees, which it is usually recommended to plant at a distance of twenty-one feet, or 100 trees to the acre. Now I have no hesitation in saying, that to set out peach trees on the square at twenty-one feet from tree to tree will be found a most inconvenient method where the trees are to be irrigated. The system may do very well for an orchard not under irrigation, as it gives an equal opportunity for cultivation both ways, that is along the rows and crossways; but in the case of irrigation a much greater space will be required between the rows along which the irrigation takes place. Not only is additional space required in which to open the irrigating furrows, but also for the subsequent cultivation, and on land sufficiently strong to make a six-year-old peach tree spread twenty-one feet, or even eighteen feet, the alleys between the rows will not be found sufficiently wide to permit the various operations of irrigation and cultivation to be carried on efficiently. Or on the other hand, if, on account of the weaker growth of the trees, twenty-one feet be found sufficient for the alleys along which the irrigating furrows run, then the distance of twenty-one feet is too wide the other way, and it would have been more economical to have set the trees out twenty-one feet by sixteen, or say 125 trees to the acre.

I do not propose to lay down a rule for the proper distance at which fruit trees should be planted, as this will depend entirely upon the size to which they may be expected to grow under the varying circumstances of climate, soil, etc. I merely wish to point out that in order to give space for irrigation and cultivation, the distance between the rows along which the water runs should be at least six feet wider than the distances at which the trees are set in the rows. As I have already remarked, twenty-one feet on the square will not be sufficiently wide if the trees grow to a distance of eighteen feet, but exactly the same number of trees can be set out to the acre if the rows are made twenty-four and a half feet wide and the trees eighteen feet apart in the rows.

The water should not be allowed to come up to the trunks of the trees, and there will therefore be a strip of land on each side of the rows varying from three to six feet, according to the age of the trees, which will never receive water. On this strip the want of water, and, as the trees grow larger, the heavy shade will prevent any rampant growth of weeds and it can easily be kept clear by an occasional hand-hoeing, while the wider alleys will give ample room for horse cultivation.

In the collection of the fruit these alleys will also be found a great convenience.

Moreover, a much larger number of trees may be successfully grown upon the same space by planting somewhat thickly in the rows, provided the rows are wide enough apart to allow sunlight and air on two sides of the trees. For instance, trees at eighteen feet apart each way may form a perfect thicket in a few years and exclude the sunlight and air to such an extent that they will all become weakened. The same trees set in rows twenty-one and a half feet wide and the trees fifteen feet apart in the rows will do much better, although there will be exactly the same number on the ground, but the wider rows will admit a current of air and light, without which no tree will thrive in any climate.

There is yet another advantage in favor of the alley system and it is this: Suppose you are setting out some new variety and don't know exactly how large it may ultimately grow. You are not sure it will grow to more than fifteen feet in diameter, and on the other hand it may grow to thirty feet. If you were adopting the old square system you would probably venture to put them out at twenty feet, or 110 to the acre. Should the trees be found to need only fifteen feet you are wasting the ground, while if they ultimately need thirty feet, you can only meet the emergency by cutting out every other row and every other one in the rows left, which would reduce the number per acre to only twenty-eight. But on the alley system you would plant out your 110 trees per acre twenty-five feet by fifteen, and if you found the trees really grew to a diameter of thirty feet—that is, a spread of branches thirty feet in diameter—you could meet the difficulty by cutting out every other tree in the rows and so have the orchard thirty feet by twenty-five, or about fifty-five to the acre.

In planting slow growing but long lived trees, this alley system offers the advantage of gathering several crops from a larger number of trees before they need additional space. Pear trees will often bear several crops before their branches extend over twelve feet, and yet the tree may ultimately grow to twenty-four feet in diameter of spread. To set out the orchard in the first place at twenty-four feet entails a great waste of land and labor for many years, while to put them out at twelve feet will soon make irrigation and cultivation extremely difficult, but if you set out your trees twenty-four feet by twelve, you can go on for many years before you need to cut out every other tree in order to leave them twenty-four feet apart. In the meantime you can grow corn or vegetables in the wider alleys and economize space. By the by, perhaps one of the greatest advantages of the alley system is that it gives more space for growing crops between the rows of trees until the latter come into bearing.

WINTER IRRIGATION.

BY J. W. GREGORY.

IT is an excellent practice to irrigate some ground thoroughly in the winter season, if you have the water, so as to have the help of the frost in mellowing and subduing the soil.

It is a good thing to flood new ground that you have just prepared, if you have the water. It will show you where you need to put the finishing touches in the leveling process. Unless the ground is very moist, it is well to irrigate your ground before planting any small seed or grain. The plants come up quickly and get a good start; the seeds sprout evenly and fewer fail to come.

Having your crop once well started and kept thoroughly cultivated, further directions may be condensed in the simple admonition, water whenever it is needful. It would take columns of details to attempt to specify all the minutæ as to time, stages and conditions of growth of different crops with reference to putting on the water. Any husbandman of experience can tell when his crops need rain. Having his reservoir always full, he simply proceeds to bring on a shower whenever it is needed, and just where it is needed.

Some crops may safely be flooded, as alfalfa, the small grains, onions, etc., but with others, notably maize and Irish potatoes, it is very important that the water be kept well down in the furrows between the rows, and not allowed in any case to rise about the plants.

Most important of all, it should be borne in mind that, important as is irrigation, thorough cultivation is still more so. To soak up the ground time after time, only to let it stand and dry out as hard as a brick, is to waste seed, water, time and labor. A thorough irrigation tends to compact the soil. Unless the surface is thoroughly stirred at the proper time the ground, unless it is very sandy, becomes very hard, evaporation is rapid and plant growth is retarded, or even smothered out.

It takes prompt work, and a great deal of it, to till the ground at the right stage after each irrigation, but it pays to do it, and the farmer cannot afford not to do it. It will lead to his handling less ground, but he will get enough more off the area tilled to amply compensate for the extra labor. After all, is it not better to thoroughly fertilize, irrigate and cultivate an acre of ground and get a whopping big crop off it, than to spread out a great deal more of labor, time and seed on ten acres and get only as much of a harvest as off the intensively tilled one acre?

If the ground to be irrigated is rolling, the water will necessarily be conveyed in ditches which curve about to suit the necessities of the case, and oftentimes the crops will need to be planted in rows which follow the windings of the surface.

If the surface to be irrigated is steeply sloping, the water must be applied along lines which run across the slope—not down it—to prevent washing out ditches and crops, and to retain the water in place long enough to allow it to sufficiently moisten the soil.

UTAH FARMERS STRONGLY ORGANIZING.

THE Utah State Agricultural Society has issued a lengthy address to the farmers of the State which contains the following: The matter of most pressing importance at the present time is legislation, and it just so happens that the first State Legislature will be called upon to deal largely with the farming interests. Do the farmers know what is best to be done and what is best not to be done in regard to the following topics? First, the confirmation of water-rights that have accrued; second, the establishing of new water-rights; third, the proper protection of forests; fourth, the disposition of school lands; fifth, the rights of the settlers already on the school lands; sixth, location and disposition of the lands that will come to the public institutions; seventh, lands that will come to this State through the Carey act; eighth the sheep and general stock inspection laws; ninth, the bee inspection law; tenth, the fruit-tree spraying and inspection laws; eleventh, filled and skim-milk cheese; twelfth, the oleomargarine and its effects on the butter trade; thirteenth, the State fair; fourteenth, the state of our agriculture and the general supervision of all agricultural interests. Let all agriculturists in Utah look this list over and see if they understand the different topics, remembering that, whatever is done or whatever is neglected in these matters, the farmer will have to pay for in the end. It is designed that every county throughout the Territory shall organize an agricultural society which shall be a branch of the State society. And inasmuch as it is the intention of the committee to call a meeting of the State association during the holidays, when low rates are in vogue, we would suggest and earnestly solicit the agriculturists of each county to organize these branch societies immediately and arrange to send as many representatives as possible to our State meeting in December. We desire at that meeting to have a very large attendance and a general representation throughout the Territory, as matters of very great importance will come up for discussion and determination. Among others, we want to appoint and organize a strong legislative committee, whose duty it will be to go before the Legislature and work for such measures as will best serve all agricultural interests. For further information address any of the undersigned, A. A. Mills, president, Logan, Utah; Heber Bennion, vice-president, Taylorsville; Philip A. Dix, secretary and treasurer, Salt Lake, Executive Committee.

PREPARING LAND FOR SUGAR BEETS.

THE full preparation of the land for sugar beets is a very important part of the culture. Fall plowing is one of the best ways of giving the plants an early start in the spring, and most lands should be prepared immediately in the fall after the last crop is harvested. Corn land that is to be planted with sugar beets needs to be cleared of the cornstalks just as soon as possible. In the fall our weather is generally very dry, and the soil is frequently parched also. If any crop is taken off, and the soil left exposed for a few weeks to the hot sun, it will become dry. The great thing necessary in the fall then is to get the land plowed over, the weeds killed, and the soil so pulverized that the moisture will sink into it and not run off.

Subsoiling and surface plowing in the fall should be attended to, no matter what crop has been raised, and the sooner this can be done after the corn is harvested, the better conditions will prevail in the spring for the sugar beets. On most lands manure should be spread over the soil after the crop is harvested. Unless the land is exceptionally rich, well-rotted manure should be spread over the land immediately

after the shallow plowing in the fall. The rains of fall that may soon follow will then wash the strength of the manure into the surface soil, where it will remain until spring. If the manure is spread over a hard surface that has not been plowed the best of its strength is apt to be washed away by the winter rains and snows.

It should be remembered that manure is of little value to sugar beets unless it is thoroughly decomposed. The manure that is given to the soil in the spring of the year is not used as a rule by the sugar beets until late in the season. It is not directly available as plant food. Occasionally one can get manure sufficiently decomposed to be taken up immediately by the beets, but this is rarely the case. Consequently, fall manuring on freshly plowed ground is the best method. By spring this manure has rotted thoroughly, and the strength of it is in an available form so that the young beets will use it at once. It will give them an early start and carry them along successfully until the spring manure is ready for use. Subsoiling is the best in the fall, but if this cannot be done very well, surface plowing ten or twelve inches deep will answer. If the manure is not ready for use, it should be kept piled in a heap through the winter. Water should be thrown over the heap in dry weather, just enough to keep it moist enough to prevent overheating. Too much moisture, however, will prevent decomposition, and this danger should be avoided as much as the other. If properly handled the manure ought to be ready for spreading over the ground very early in spring, and it will be in pretty fair condition for the beet plants to use.

New soil is not as good for sugar beets as old soil that has been properly treated. The trouble with a great deal of our old soil is that it has been overworked and starved, and hence the beets do not thrive well.

Milking by Machine.—From time immemorial the cow has swished her tail, kicked over the milk-pail and been mistress to a certain extent of all she contained. But hereafter she will have to accommodate herself to a labor-saving device which will pay little regard to her feelings in the matter. This milking machine has been invented in Scotland. It is said to work perfectly. It is known as the "Thistle," and an English farm paper says of it: "The most successful milking machine yet invented was recently shown at the Darlington fair, where it attracted more attention than any other novelty on exhibition. The machine has been so thoroughly tested by experts that it is now considered to be almost perfect, and it has given so much satisfaction as to warrant the erection of large works for the manufacture of the machinery. Its construction is based on the principle of suction produced by vacuum in a teat-cup, which, pressed against the teat of a cow, extracts the milk, which is carried off to a receiving-pail. While the teat is drained of its milk, air enters the cup, allowing the former pressure to relax, and the teat is again filled with milk from the udder. Vacuum is once more created in the teat-cup, which again collapses, pressing out the milk into the tube, and it then passes, to be received as before. The exhaustion is, of course, effected by means of an air-pump, which can be worked by the motive-power most convenient. The most obvious advantage to be derived from a milking-machine lies in the fact that a large number of cows can be milked with the employment of but few hands. This is a matter of greater importance in dairying than in most other lines where machinery is sought to be introduced, because, while in other lines it may cheapen production in dairying, the number of cows that can be kept is limited by the number of hands that can be kept busy on the farm outside of he milking hour."

Suggestions as to Subsoil Plowing.—Subsoil plowing, although a means of conserving moisture, does not produce it, and is, therefore, not a substitute for irrigation where the rainfall is too small to produce crops. Where there is a hard, dry subsoil, subsoil plowing is to be recommended. Where the subsoil is loose, gravelly, or sandy, subsoiling is probably unnecessary, or may even be injurious. Do not subsoil when the soil is very wet, either above or beneath, as there is great danger of puddling the soil, thus leaving it in worse condition than before. This is one of the reasons why it is better to subsoil in the fall than in the spring. If the ground be subsoiled in the fall the winter and spring rains have ample opportunity to soak in, that being the season of greatest rainfall and least evaporation. Subsoiling in the spring may be a positive detriment if the subsoil be extremely dry, as in that case the rain water is partially removed from the young plant by the absorption of the bottom soil. If the spring rains were heavy this would not be a disadvantage. The effect of subsoiling land having a "gumbo" subsoil has not been ascertained, but if done at the proper time it would doubtless be beneficial. The "gumbo" subsoil, to a greater extent than any other found in this State, prevents the moisture from penetrating deeply into the soil, and as a consequence such lands are the first to suffer during a drought. If the "gumbo" could be loosened it would obviate this to a great extent. Understand the nature and condition of the subsoil on your farm before subsoiling.

The Best Averages.—In the government statement of the yield per acre and condition of crops in 1895, Western America comes to the front in this style:

Rye—Average yield for United States in bushels per acre, 14.4. Best State average, Washington, 26.7; second, North Dakota, 21.3; third, Minnesota, 21.1.

Oats—Average for United States, 29.6. Best State average, Iowa, 46.2; second, Vermont, 43.8; third, Washington, 40.3.

Barley—Average for United States, 26.4. Best State average, Washington, 37.3; second, Minnesota, 36; third, Kentucky, 33.3.

Hops—Average for United States in pounds per acre, 656. Best State average, Washington, 1,533; second, Oregon, 1,511; third, California, 1,325.

There is just one other summary of yields per acre —wheat. Here is where Washington, according to the official reports, is not in the race. The average yield for the United States in bushels per acre is 12.5. Old Vermont takes the lead with an average of twenty-nine bushels; Wyoming comes next with 28.3; and Washington—surely through a huge blunder—comes seventeenth in the list with an accredited average of fourteen bushels per acre.

Marketing Poultry.—Good fat stock can be sold to better advantage dressed than alive, for the simple reason that the quality of the stock will be more apparent to both buyer and seller at the time the sale is made and a better price should be obtained. That it will pay in the majority of cases to sell straight, well-sorted stock is thoroughly appreciated by all stockmen of large experience. This fact is not only proved by the experience of those who have re-

peatedly demonstrated it, but also by the eagerness manifested by the average dealer to buy mixed lots, for he well knows that he can, as a rule, get this class of stock enough cheaper so that he can make a good profit by sorting them up and filling orders. It is a rule which applies with as much force to farm produce as to morals, viz., that the inferior is much more apt to drag down the superior than is the superior to improve and elevate the inferior when they are associated together. One of the most surprising things is that farmers' wives will allow a huckster to go into their flocks and pick out the best and leave the poorest. They should do their own sorting, and then let the buyer take it or leave it, just as he chooses. In dressing stock great care should be taken to put the stock in the condition which will render it most salable when it gets to market.

Winter Dairying.—If winter dairying is not practiced, a change to that, either wholly or largely, will materially increase the profits. In perfecting this change a special preparation is necessary. A warm, well-ventilated stable, if not already provided, will be the first essential. An abundance of the various kinds of milk-producing food should also be provided for the support and well-being of the herd. For this purpose nothing is better than a good quality of hay (clover or alfalfa being the best) and good corn ensilage for roughage, with bran, cornmeal, oat and pea meal, and cottonseed meal in connection. With these facilities, and a fair lot of cows and a careful man to attend to them, the dollars will come in for all extra outlay. With winter dairying the cows will remain dry during August, while the feed is short, and through the worst season for handling dairy products, instead of February and March, and will give the dairymen the best portion of the year for making butter, and fair prices. The calves dropped in September or October will be well started by winter, will escape the worst part of the year for flies and heat, and will be in good shape to turn to grass by the following spring.

No Over Supply of Good Horses.—Notwithstanding electric power, good horses are always desirable, and will in the near future bring better prices than now. Farmers will understand what they need, and for a while, perhaps, the supply will be short of the demand, but the price will again settle to a fair compensation for the trouble and risk in raising good horses. Good family horses will always be in demand in the cities and in the prosperous villages. Electric cars may carry men to business and women to their shopping, but there is a demand in hours not spent in business for a carriage horse to supply a need felt by almost every well-to-do family that may have a restful airing in the country or in the parks and suburbs of the cities. Farmers would do well to turn their attention to raising horses to supply this want. Horses should be raised of the best blood, not for the turf, but for the carriage, and as much care should be taken in their training for this purpose as is necessary to good conditioned, quiet, trusty horses suited to driving through all the bustle and noises of the city.

Burying Potatoes.—Select a place with good surface drainage away from where the pile is to be made. It is all the better if on north side of trees or buildings, so as to be sheltered from south winds. Make a pile on top of ground, about three and a half feet wide, and as long as you please, and pile up as high as you can on this base. A long, narrow pile is better than a round one of considerable size. It will cool down quicker. Put seed potatoes in cellar until ground gets cooler than cellar, just before winter. Then when it is cold, near freezing, draw them out. First put over a layer of straw, say what will pack down to four inches, then about four inches of earth. Wait for this earth to freeze a little. Then put on another layer of straw and eight to twelve inches of earth well topped out. The straw should be put on with care, so as to shed water, same as you would top out a stack of hay. The two air-spaces in the two layers of straw make freezing impossible; at any rate, we have never lost a tuber, and we have kept many bushels of seed in this way. Late in winter cover the pile with about three feet of straw mulch, when the earth on the pile is frozen deeply. This will keep the frost in and the potatoes will not sprout so soon. Your greened potatoes are all right for seed.

Feeding Potatoes.—The value of potatoes as food for cattle has for some time past been a subject for consideration by the French Ministry of Agriculture. M. Gerard has just issued a detailed account of a second series of experiments. The only addition to potatoes was straw to begin with and hay afterward. The results fully confirmed those of the first trials, showing a diet of potatoes to be very economical in the production of meat, cooked tubers having again proved superior to raw ones. The plan pursued was to boil or steam the potatoes, mixing them afterward with straw or hay chaff, adding a little salt, and leaving the mass for twenty-four hours to ferment slightly before using it. In addition, a little loose hay was given. The average daily ration of a bullock in three meals was 10.5 pounds of potatoes, six and a half pounds of hay chaff and thirteen pounds of loose hay. For a sheep it was five and one-half pounds of potatoes, a little less than three-fourths pound of hay chaff and one and one-third pounds of loose hay.

Sorghum a Good Product.—Mr. George Stewart, of Crow's Landing, Cal., is looking into the matter of sorghum raising says the Newman *Tribune*. This year he sowed ten acres to sorghum seed and, taking into consideration the fact that it was an experiment with him, and further that no especial cultivation or care was given it, raised a fairly good crop.

Hope for Wheat Growers.—J. A. Filcher, secretary of the California State Board of Trade, does not take the despondent view of wheat-growing that has been widely held and confidently proclaimed. It has been the opinion of many that the wheat area of the world is only partially developed, and that the yield of the future from new fields will make the supply so great that wheat-growing will no longer be profitable. But Mr. Filcher holds that the maximum yield of the world has practically been reached, and that growers need not fear a greatly increased crop from any country in the world.

As to Cheese.—The purpose of cutting the curd, in cheese-making, is to facilitate the escape of the whey. Before adding the rennet in cheese-making, stir in the coloring matter, first diluting it with water.

Fall Plowing.—The effects of fall plowing are not only shown on the land and the next year's crop, but it is less exhaustive and wearing on the team. In the fall the horses are in the best condition for work and their muscles are in the condition which only constant exercise produces.

Cottonseed Meal as Feed.—Sheep soon learn to like cottonseed meal. Some will refuse it at first, as will also some cattle. In the Cornell experiment station bulletin No. 47 is a record of feeding lambs weighing on an average a trifle less than 60 pounds each, from December 8 to April 27 inclusive. The ration, for lot 1, for five lambs for a period of 140 days was: Wheat bran 382 pounds, cottonseed meal 191, linseed meal 96, hay 606, corn ensilage 1,166 pounds. The gain was 26.5 pounds per head. As most readers are better acquainted with the gain in cattle than in sheep, the weights, etc., might be applied to steers. Fifteen of these lambs would equal a 900-pound steer. Since each lamb gained 26.5 pounds, fifteen would have gained 397 pounds. If a steer of 900 pounds be substituted for the fifteen lambs weighing 900 pounds and the total gain be divided by 140, the number of days the lambs were fed, it shows a phenomenal gain of 2.8 pounds per day for the steer.

Improving Sorghum.—Professors Failyer and Willard began in 1888 a line of work which is of much importance to Kansas farmers, and others, not only in the matter of improving a certain variety, but also in showing the method of improving seed generally. They began experimenting with several hundred sorghums, but rejected all but a few of the most promising, after careful trial. The seed of the best stalk, as shown by the per cent of sugar it contained, was saved each year and used for seed the next, and so on. By this method, the average per cent of sugar in Kansas Orange sorghum has been increased from 12.62, in 1888, to 17.3 in 1892. Early Amber yielded 13.95 per cent in 1889 and 15.62 in 1892. Link's Hybrid yielded 14.01 per cent of sugar in 1888, and 16.4 per cent in 1892. In their report they say "while other causes influence the per cent of sugar in different years, there still remains a large improvement which can be accounted for only by admitting the efficiency of persistent scientific seed selection."

Experiments in Hog Feeding.—An interesting experiment in hog feeding is in progress at the Union stockyards at Salt Lake with wheat as the diet, the result of which will be given to the interested public from time to time. About thirty days ago a lot of pigs were put on full feed, weighing at the time 71 pounds. For the first twenty-three days they ate an average of four pounds of steamed whole wheat per day and made an average gain of one pound each per day; during seven days they ate five pounds of wheat per day, which had been previously soaked for twelve hours, and they gained nearly two pounds per day, their average weight being 106 pounds. The soaked wheat (whole) feed would be continued another week, when a change to chopped wheat and barley, mixed half and half, would be made.

Beet Sugar—The Las Vegas *Stock Grower and Farmer* says: "The shortage of the European beet sugar crop this year is estimated at 1,200,000 tons. The New Mexico wool crop is worth about $3,000,000 to the Territory. Now compare the worth of the entire wool crop of New Mexico with the low estimate we have made of the possible result of the sugar beet crop that could be raised here under the changed conditions of the grant title settled and irrigated farms running, and it will be observed that the value of the sugar beet crop of this immediate locality would tread close to the heels of the value of the entire wool crop of New Mexico."

What Ails the Cheese Industry.—Now add the reduction of the home demand through making of poor cheese, skim cheese and "filled" cheese, and we can see at once that it is not overproduction that is hurting us, but rather under consumption, says *Hoard's Dairyman*. What makes it all the more exasperating is that the farmers and factorymen are the only ones practically to blame for this condition of things. The farmers are to blame for not standing up like men of common sense, saying: "We will not allow our milk to be made into anything but the best cheese possible. We will not be party to any blind, silly attempt to destroy the demand for cheese." The factory men are to blame for not standing up and together, like men of ordinary sagacity, saying: "We will not be party to any attempt to discourage and eventually destroy our business of cheese making." Here are the two parties who can force out poor cheese and all frauds if they will. They will find that they will need all the consumption they can get to keep up the cheese market of the future.

Practical Experience.—This spring I sowed 1-16 of an acre to onions and harvested over seventy-five bushels, averaging about one pound apiece. They were the prize-takers. I also had 1-50 of an acre planted to Little Bartetta and White Queen onions. Off of this piece I harvested thirteen bushels and thirty pounds. I had fourteen bushels of potatoes on 1-16 of an acre. My strawberries made an average of 13,000 quarts to the acre. My beets and celery have not been harvested, but they will be very heavy.

I irrigate about two acres, and use an old-fashioned ten-foot windmill and an ordinary four-inch brass lined cylinder. I have been irrigating for five years in this manner. When I came to the place I now live on, there was but one tree on it that I did not have to dig up on account of the way they had been set out. I now have a pleasant little home, with about thirty-five shade trees, from six inches to a foot in diameter, forty plum trees, twenty-five apple trees, twelve pear trees, fifteen cherry trees, and about fifty gooseberry bushes, and about twenty grape vines. I also have a very fine blue grass lawn and lots of flowers.

My reservoir is thirty-five feet in diameter, and sodded outside and in, and has a row of weeping willows on the bank and a variety of water plants growing inside. It is well stocked with fish that are so tame they will eat out of my hands.

All this I have accomplished with very little expense outside of my own work. $100 will cover all money paid out.

These are luxuries that all farmers, who have an ordinary windmill and water to supply a four-inch pipe, may enjoy. They not only promote health and happiness, but are a source of quite a little income.

A. H. MOFFET.

Preventing Hog Cholera.—The Texas *Stockman* says: "Our northern exchanges are filled with long articles headed, 'Beware of hog cholera.' The hog cholera scare cuts but little figure with the Texas swine grower. The fact is, that where ordinary sanitary precautions are observed hogs are practically free from disease in this State."

Exercise the Hens.—Without exercise for the hens the egg-basket will be empty. To obtain this it is not necessary to hire a boy to chase the hens around the yard. All that is necessary is to make them scratch. This is the first lesson in poultry-raising. To make them scratch it is not necessary for your neighbor to have a garden. If he doesn't want to keep a garden it is not worth while insisting on it, because a hen will scratch in your own yard if her feed or grain is scattered in straw a foot or so deep. Exercise works like magic on a hen.

Inspection of Fruit Trees.—C. A. Tomeson, secretary of the Washington State Board of Horticulture, makes the following suggestion: As the planting season approaches it behooves every orchardist or person who is preparing to set out fruit trees to see that the stock is free from any injurious insects or other pests. Members of the Board of Horticulture will exercise the greatest possible care that all fruit trees are inspected, but fruit-growers and persons interested are requested to aid in this work by asking those selling or distributing trees to show certificates of inspection.

Destroying the Chinch Bugs.—Chinch bugs winter in old dead grass, cornstalks and such places. If all the trash is destroyed now, the bugs will merely crawl into cracks in the ground and stay there. Freezing does not destroy the bugs, as has been shown by Prof. Lugger of Minnesota. He put some out-doors and sprinkled them with water so that they were imbedded in ice. After they were thawed out, they attacked the green plants near which they had been placed. If all the trash is burned at "clearing-up time" next spring before the ground thaws out many of the bugs will be destroyed.

Manure.—Manure will give a greater return if put into the soil as fast as it is made than it will if it is left in heaps to steam. If left in heaps, the ammonia escapes into the air and may help to enrich the land of some farmer several hundred miles away.

Objection to Shade Trees.—An objection to shade trees along the roadside is that they injure the adjacent crops. This injury is done by the roots rather than by the shade, as the same soil cannot nourish two crops at the same time. Sever the roots on the field side by digging a trench. The ground can then be successfully cultivated with almost any crop.

More Poultry.—In the variety of farm products poultry may become a source of income at all seasons of the year; but aside from this, the farmer should have more chickens to save the butcher's bills, and to afford him a change from pork and salt meats. We do not produce enough; the city markets are rapidly growing.

Feed For Winter Stock.—Make a stack of early cut sweet corn in alternate thin layers with old hay. The hay will keep the corn from molding, and the corn will impart its sweetness to the whole. This will make feed for the winter stock which will be eaten up clean and greedily, and nothing could be better for the young stock and milk cattle.

Cow Peas.—Cow peas are often sown broadcast in the field at the time of "laying by" the corn, and are well started by the time the corn is in full ear. They are knee deep about the time the corn is cut off, and are plowed under, and lo! the field is as good as new again. This is no longer a monopoly in the South, for more northern latitudes have grown this pea successfully.

Early Lambs.—If you expect to grow early lambs for the market next season, make up your minds now at what time you want the ewes to lamb, and turn the buck into the flock accordingly. The period of gestation runs from 145 to 160 days, and the lambing season will, therefore, begin in twenty-two or twenty-three weeks.

Cutting Corn by Horse Power.—A recent invention, of L. M. Weaver, Bethel, Mich., is adapted to cut corn by horse power and presents the advantages of allowing the operator to ride, while he is relieved from using the corn knife personally, the cutting being done by an oblique blade that takes a long draw cut.

Packing Fruit.—A New York dealer of long experience, in a letter commending the fruit of a certain grower, which had aroused his admiration because of its admirable packing, by reason of which it was made to pay, said: "If the fruit-growers in Western America will ever learn that there is more in packing fruit than raising it, then, and not till then, will there be profit in their crop."

Raising Flax.—New Zealand flax is cut chiefly from the swamps, marshes and river banks. It has been imported to this country in large quantities, but it is claimed that it can be successfully raised in California.

Paper Horseshoes.—A German veterinary surgeon has discovered a method by which horseshoes can be successfully manufactured from paper. The paper is impregnated with turpentine to make it waterproof. The inventor claims that a horse wearing these shoes cannot slip on greasy roads.

Too Many Brands.—Tens of thousands of Texas steers are now selling at from $2 to $3 per head less than they would have brought but for the numerous large brands that have been placed upon them. A dozen big brands may have been necessary in the days of free range and at a time when might made right, but under changed conditions there appears to be no necessity for the heavy loss caused by branding the whole side of an animal.

Harvesting Sweet Potatoes.—The keeping quality of sweet potatoes depends more upon the time and manner of harvesting than does almost any other farm crop. It is almost useless to think of saving them for any length of time if they are taken out of very wet ground, especially if it has been wet for a week or ten days before digging. In such a case it is better to leave them in the ground until it becomes at least dry enough for good plowing.

Picking Ducks.—Ducks and geese should always be scalded, and steamed by covering up with a blanket for a short time before picking; in other respects handle as turkeys and chickens.

Pruning Fruit Trees.—Prune trees so as to make them symmetrical, and so they will shade their own bodies. Cut back the branches so they will bear the weight of fruit, and the fruit-bearing twigs so the load will not be too heavy.

Quince Culture.—The culture of quinces is profitable where the soil is suitable for their growth. Usually a strong, loamy soil is suitable, but in some sections they do not seem to do well through climatic influences. There are two ways of propagating quinces: One is by bending down small branches and covering all but two or three buds. This is done in the spring, and by fall roots will have started from the branch, and it may be struck from the parent tree and set where it is to grow. Another way is to strike cuttings in the fall and set them out as would be done with currant cuttings.

Planting Lily Bulbs.—Autumn is the time to plant lily bulbs. Then you are almost certain of flowers the next summer. They always show finely among shrubbery, which also gives the partial shade they like, and the roots of the shrubs remove an excess of moisture. Plant six inches deep in rich mellow soil. Use fine, well-decayed manure as a winter mulch.

Transplanting Roses.—Roses may be transplanted in December, though it is rather better to do the work in the spring. But fall setting is often more convenient. The bed must be well drained, deeply dug and made very rich with well-rotted cow manure. Crude, green and fermenting manures are very bad for roses. Lift with as many roots as possible, shorten the larger ones and keep on as many fibers as you can. Set a little deeper than they were before, and firm the soil well.

Success with an Incubator.—There is no secret about how to succeed with an incubator. It is simply a matter of keeping the temperature as near 103 degrees as possible, and not allowing it to get above 105 nor below about 92, though it may run to two degrees above or five degrees below these limits for a short time without injury to the embryo chicks. The difficulty with most people who try to operate an incubator is that they get excited and worry the machine too much. If we had a hen sitting and should take her off the nest from ten to twenty times a day and look at the eggs through a tester and all that sort of thing, we should not look for a very good hatch; and it is the same with an incubator.

Winter Apples Will Pay.—The shrewdest observers among our farmers some time ago made up their minds that the raising of winter apples offered more inducements than any other undertaking, and many trees have been set out in the valley in the past two years, says the Ellensburg *Register*. This belief, judging by the activity now being displayed in this direction, is an abiding one, for more trees are being planted this fall than at any time in the history of the valley.

Vacuum Canning.—A new vacuum process of canning fruits in glass has lately been introduced from Europe among the packers of the Pacific coast. All the deleterious gases generated in cooking the fruit, and even the air, are extracted under this new process, so the fermentation is reduced to a minimum. No solder is used, and each jar is opened by making a puncture with a penknife, after which the cover can be lifted off entire. The fruit is solid packed. In this way there is a saving of freight charges. Formerly the use of resin, acid, solder and hot iron scorched the syrup, and since the aperture in the top of the tin cans was so small that the fruit was often crushed and cut when being placed in the cans, the syrup was for this reason cloudy.

Protection from Rabbits.—A simple way of protecting trees from rabbits and all similar pests is to take a wire screen, such as is used to keep out mosquitoes, cut into strips about nine inches wide, coil the long way around a broom handle; then, when trees are set, spring these coils around the tree; settle well into the earth, and make the lap on the south side. They will fit tightly and remain until the tree is three inches in diameter. No need to tie the netting; it will keep its position if it has been properly coiled.

When to Apply Fertilizers.—The proper time to apply fertilizers for clover is with the wheat in the fall. A liberal supply of potash with the wheat manure, will not only realize the highest efficiency of the other fertilizing elements present, but also materially assist in obtaining a good stand of clover. That potash and lime are the two most important fertilizers for clover is now pretty generally understood.

Chicken Cholera.—No confidence is placed in remedies for chicken cholera; prevention is the only thing that can be done. When cholera breaks out among the fowls the first thing to be done is to separate the sick from the well ones. At once give a change of food, which should be of a nourishing character.

More Work for Horses.—Three times as many horses as were used in the street cars are now used in the increased wagon traffic in every city, as the natural growth of commercial interests. More wagons, better wagons and larger wagons all require better teams now than ever before.

A Laundry Cow.—J. H. Hearn, of Austin, Tex., is the owner of a fine Hereford cow whose milk of late has been developing some peculiarities. He says to pour a little of the milk into warm water produces almost perfect starch, and when the milk vessels are washed the cleaning water becomes thick and starchy. He is anxious to learn the cause.

Demand for Dairy Cattle.—There has been more demand in Texas this year for improved dairy cattle than for several years past. Breeders of this class of cattle say they are entirely sold out of their surplus stock, and they could have sold many more.

Winter Butter.—Winter butter must be good enough to compete with oleomargarine. If it is not, it will pay better to fatten your cows and send them to the butcher.

Hold Your Cotton.—Commissioner Rose of Texas notifies the farmers of a large decrease in the acreage of cotton this year and advises them to hold on to their crops.

MAXIMS FOR THE IRRIGATED FARM.

Do not irrigate oftener than you cultivate.

Do not sow alfalfa in your apple orchard unless you want to kill the trees.

Prepare your bed for asparagus this winter, and remember that it will probably last your lifetime.

Tomatoes should never be raised on the same land two years running.

It does not follow that a climate suitable for winter apples is equally suited to winter pears. The latter require a long, hot summer.

The trees in the orchard require as much moisture in winter as in summer.

Have two alfalfa pastures to grow and fatten hogs. One pasture to be fed while the other is being irrigated.

The soil does not need irrigation whenever it is moist enough six inches deep to roll up into a ball.

Don't plant cottonwood trees near any other growing plant or tree. The cottonwood is a great robber.

Only intensive farming pays under irrigation.

Remember that the hens cannot digest their food without gravel or grit.

Keep the cows supplied with a piece of rock salt.

Don't plow a bigger bit of land than you can cultivate.

A good windmill will always supply food for one family.

Sub-irrigation by means of perforated pipes is a beautiful theory, but it is too costly.

If the water has given out, cultivate well before the ground bakes and cracks.

Keep a record of how the trees are planted in your orchard.

It does not take two men to plant a tree. Drive a stake into the center of the hole, tie the tree to it, and you can do the job alone.

A strawberry bed is not profitable after it has raised three crops of fruit.

The contents of a farmer's library is a sure index to the state of his orchard.

Do not neglect your farm because you want to sell out.

An orchard of winter apples is on the average worth more than an orange orchard.

Always select a farm that is close to good markets.

Shredded corn fodder, with an equal ration of alfalfa, is the coming winter feed for stock.

Trees are more often planted too close together than too far apart.

It is a disputed point as to whether whole-root grafts are better than good piece-root grafts.

Never keep a cow that will not make 300 pounds of butter in the year.

Captain Jack and Manchester are considered two of the best strawberries to raise by irrigation, as they carry their fruit high and so keep the berries out of the water.

Always set out your trees so that the rows are wider one way than the other, and then give space for irrigation and cultivation.

The constant cutting off of the leaves with a hoe as fast as they appear above ground will kill any weed that ever grew.

For the profitable cultivation of the olive the temperature must never fall below fourteen degrees over zero.

The object of cultivation after irrigation is threefold: To get rid of weeds, to retain moisture and to aerate the soil.

The thrifty farmer will never have to buy anything that he can raise at home.

He who forgets his own friends meanly to follow those of a higher degree is a snob.—*Thackeray.*

The devil knew not what he did when he made man politic; he crossed himself by it.—*Shakespeare.*

Do not accustom yourself to consider debt only as an inconvenience; you will find it a calamity.—*Johnson.*

No true and permanent fame can be founded except in labors for the happiness and good of mankind.—*Charles Sumner.*

If your eye is on the Eternal your intellect will grow, and your opinions and actions have a beauty which no learning or combined advantages of other men can rival.—*Emerson.*

In troubled water you can scarce see your face, or see it very little till the water be quiet and stand still; so in troubled times you can see little truth; when times are quiet and settled, then truth appears.—*Selden.*

KEEP A-GOIN'.

If you strike a thorn or rose,
Keep a-goin'!
If it hails or if it snows,
Keep a-goin'!
'Tain't no use to sit an' whine
When the fish ain't on your line;
Bait your hook an' keep on tryin'—
Keep a-goin'!
When the weather kills your crop,
Keep a-goin'!
When you tumble from the top,
Keep a-goin'!
S'pose you're out o' every dime,
Gettin' broke ain't any crime;
Tell the world you're feelin' prime!
Keep a-goin'!
When it looks like all is up,
Keep a-goin'!
Drain the sweetness from the cup,
Keep a-goin'!
See the wild birds on the wing!
Hear the bells that sweetly ring!
When you feel like singin'—sing!
Keep a-goin'!

—*Georgia Exchange.*

THE PROGRESS OF WESTERN AMERICA.

A PROMINENT NEW MEXICAN.

COL. MAX FROST, member of the National Committee from New Mexico, is a resident of Santa Fe, a native of New Orleans, La., and a little over forty years of age. He is a lawyer by profession and came to New Mexico when quite young. He has held many offices of honor and trust in the Territory; was adjutaut-general of the Territory under acting Governor Ritch and Governnors Lew Wallace and Lionel A. Sheldon, and colonel of the second regiment of New Mexico volunteer militia for six years. As adjutant-general and as colonel he saw active service in command of Territorial militia in several Indian campaigns and against rustlers, and put down serious disturbances with rustlers and desperadoes in Rio county in 1881. He was registrar of the United States land office in Santa Fe from 1881 to 1885; a county commissioner of the county of Santa Fe, and a school director in the city of Santa Fe for several years. He has been for six years secretary of the Territorial Bureau of Immigration of the Territory and it is universally acknowledged that in that position he has done most excellent and valuable services to the Territory, both in the very fine and able publications of the bureau and in numerous newspaper articles. His work, published in 1894, on New Mexico, descriptive of the Territory, and containing over 100 illustrations and about 350 pages of reading matter, is generally conceded to be the best and most valuable on New Mexico ever published. He is a great worker, and a man of fine executive talent, energy, vim, and a shrewd politician. He was chairman of the Territorial committee having the Fourth National Irrigation Congress matters for New Mexico in charge, and as such did his work successsfully and well in every respect. His re-election as member of the National Committee was a well deserved compliment, and a better man for the position could not have been chosen. For ten years he was editor and proprietor of the Santa Fe *Daily New Mexican*, and while under his charge the paper was the leading one of the Territory and was very successfully conducted. He has numerous acquaintances, especially among newspaper men, and is always at work for the advancement of the best interests of New Mexico, materially, politically, and every other way. He is a very forcible and able writer and is about as well posted on everything connected with New Mexico, men and things, as one man well can be.



MAX FROST, OF NEW MEXICO.

THE NATIONAL IRRIGATION BOARD.

THE Board of Irrigation, executive departments, held its first winter meeting in the early part of November, in the office of the director of the Geological Survey. Since the last meeting, held in the spring, two members of this board have resigned, owing to change in their official positions. The place of Mr. Bowers, Assistant Commissioner of the General Land Office, is filled by his successor, Judge E. T. Best, and that of Prof. Harrington by the present chief of the Weather Bureau, Mr. Willis L. Moore.

At the last meeting of the board it was resolved, that as the first business there should be prepared a statement of existing legislation concerning irrigation, the results accomplished in each bureau of the executive department and of the plans for the future. The executive committee made a report covering these points, and after discussion it was resolved that a copy of this report should be sent to each member of the board for consideration, the matter to be discussed further at the next meeting.

A formal ballot was taken to fill the position of chairman, vacated by the resignation of Prof. Harrington, the majority of votes being cast for Judge E. T. Best, Assistant Commissioner of the General Land Office, who was also elected a member of the executive committee. F. H. Newell, chief of the Hydrographic division, has always taken an active part in this work.

This board, composed of representatives from the various bureaus and offices having to do with irrigation and the reclamation of the public domain, was created by order of the Secretaries of Agriculture and Interior on March 26, 1895. Its object is the promotion of efficiency and economy in carrying out enactments of Congress, especially those which have reference to the work of the various bureaus, and in preventing duplication of such work by the opportunities for discussion and personal acquaintance. The heads of the divisions concerned are thus enabled to secure better co-operation and a more thorough understanding of the question of irrigation as a whole, and of the relation of the work of each to that of all.



W. C. EDWARDS, OF LARNED, KAN.
SECRETARY OF STATE.

THE HOMES OF THE WORKING PEOPLE.

BY DR. CHAS. STIRLING.

THE Eighth Special Report, by Carroll D. Wright, Commissioner of Labor, on the "Housing of the Working People," is quite worthy of considerable attention.

The rapid and radical changes which the past ten or fifteen years have made in the economic and political situation in this country may be likened to that period in the life of a growing boy when a few months sometimes will change the irresponsible, careless, easy-going boy into a sober-faced, thoughtful, anxious man.

Uncle Sam wears a very sober face in these days, and well he may. The social problems which now confront us in the United States are such as a few years ago we had supposed would perhaps have to be met by our descendants of the second or third generation, but which did not otherwise concern us. However, the unexpected course of human events has landed us squarely in front of these so-called "old world problems," and we now have a social question, or rather a number of social questions of the first magnitude, which are forced upon our attention quite as urgently as these same questions are forced upon the attention of the economists and statesmen of Europe.

The rapid and tremendous growth of the big cities of Europe and America, mostly at the expense of the small towns and rural districts, is as yet a partly unexplained phenomenon. There have been very powerful economic forces at work in the upbuilding of the big cities, and whether these forces still continue to be as potent and in as full operation as hitherto, and the big cities are to become bigger and bigger, or whether something like the old relation between town and country is to be restored, is a question upon which economists are not quite agreed.

Meanwhile we have the problem of the unemployed, and the problem of the slums, and the commissioner's report deals with this latter problem only.

The slums must go. This is the verdict of the economist, the philanthropist, and also of the socialist. The slums are a social, a political, and a sanitary nuisance.

It would seem from this report that much better progress has been made in England and Germany in the direction of housing the working people of big cities in cheap, sanitary, comfortable, and often artistic dwellings, than we can yet show in this country. However, the question is new in America.

Governmental supervision and governmental interference has gone much further in Europe than we should be disposed to tolerate in this country, but the necessity was forced upon them. Necessity knows no law, or rather necessity follows the first law of nature—the preservation of the individual and the community.

The English authorities in this connection divide the working people into three classes: Firstly, those who can and will help themselves; secondly, those who are worthy of help and who will help themselves if opportunity be given; and thirdly, those who neither can nor will help themselves, but even this class must be well looked after for obvious reasons. We imagine that it would be quite impossible to draw anything like a straight line between these different classes. When we remember how often in the history of America and Australia the sons and daughters of some of those who emigrated from old-world poorhouses and jails have, under better and brighter conditions, through sheer force of ability and merit; climbed up until they rank with the noblest and best in the land, we think it safest to be charitable in our judgment and speech concerning many of these inhabitants of the slums.

No man can estimate the oppressive force of hopeless, grinding poverty in any individual case; give the man room to breathe and you may find a man after all.

In America these problems should be comparatively simple. With much more than one-half the national territory so scantily peopled as is the great West, we are not yet crowded for room.

But here again water is the prime necessity, and our governments, State and National, will soon be forced to take action. The National government must assume a number of new functions in order to successfully meet these new conditions. Any institution of less size than the National government is too small to be intrusted with the guardianship of an interest of such transcendent importance as the water supply of this soon-to-be-irrigated empire.

FORESTRY.

BY J. S. EMERY.

IN my annual address at Albuquerque before the National Irrigation Congress I said: "I cannot leave this platform and say no word for that twin sister of Irrigation whose name is reforestation. Arid America will never be reclaimed without being reforested."

I wish to emphasize this idea in this paper; and I deem the wide circulation of THE IRRIGATION AGE a most valuable avenue through which to get this thought before the friends of irrigation enterprise, not only throughout the Great Plains country as well as the mountain States, but also before the country at large. We are all waking up to some consideration of those imminent perils now threatening us from forest destruction.

The convention of the American Forestry Association at its recent session, and the action of the



J. S. EMERY, OF LAWRENCE, KAN.
NATIONAL LECTURER OF THE IRRIGATION CONGRESS.

New York Board of Trade and Transportation, at a late meeting, have brought this forestry question freshly and forcibly to mind as a prime factor in aid of irrigation. We need a permanent and scientific forest policy established in the United States, and this need is urgent.

The early creation by Congress of a National Forest Commission is imperatively demanded by the agricultural interests of the whole land; I say the whole land, because this matter does not pertain to the arid regions alone. It vitally concerns the humid states as well.

Mr. Secretary Morton is credited with saying if the Adirondack mountain region be suffered to have its mountains and valleys stripped of their forests, then, even the city of New York will not have a sufficient supply of good water for its domestic purposes. Our people hardly know of the vast inroads to-day being made upon our timber areas by the wants of trade and commerce. That single industry, pulp, is annually eating up our spruce lumber at an enormous rate. One manufacturer asserts that it takes a hundred acres of spruce trees every year to enable him to furnish paper enough for any one of our great morning daily papers. More than a hundred million logs a year go into the remorseless mass of this single interest, and the case is for a yet increasing supply from this one species of forest trees. Then turn to the mountain regions of arid America, and observe how great is this want on destruction of our scant timber supply.

Major Powell tells us that he has witnessed one fire destroy more timber in the mountains than the whole State of Colorado has had a legitimate use for since it was first settled; and he adds that he has seen many such fires.

'Tis said that the Ohio river has been lower the present year, and for a longer time, than was ever known before. This wholesale destruction of trees has already changed local climatic conditions unfavorably; it has substituted surface for subsoil drainage; and it has almost dried up many streams, all over our land, on which our mills rely.

The lessons of history should not be forgotten by us, touching this subject. But our trouble is that the average American who is making money in using growing timber, taken from Uncle Sam's dominions, does not take kindly to these lessons. Indeed he does not greatly relish this taking of lessons from anybody. He is in for immediate returns, come from where they may, and how they may.

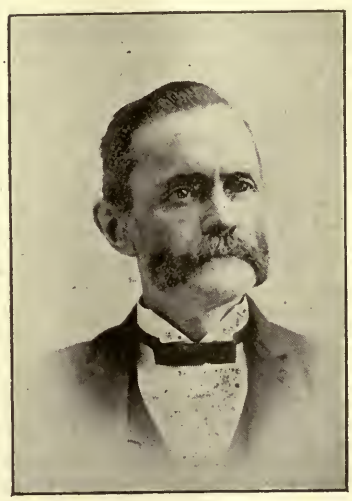
The disappearance of an empire that once flourished in our Southwest is to be attributed to the deforesting of that fair region of sunshine, blessed with the most health-giving climate in the world.

The decay of the political ascendency of Spain must be charged up to the loss and waste of her forests. France deforested the mountains and hillsides of her fairest provinces to pay for Napoleon's wars. China, India, North and South Africa have all, in turn, been notable sufferers from the wanton waste of their forests. Shall we not call a halt by law? Why not have a National Forest Commission to study our public timber lands, reserves and parks; to ascertain their condition and extent; to discover their relation to the public welfare and to existing local needs of the people; to find out what portions of the public timber can and should be kept as such; and to prepare a plan for the general management of the public timber lands in accordance with the well-known principles of forestry.

I close as I began by asserting that we never can successively people the great plains and the mountain states beyond, unless we put trees as nature once did put them, all the way from the subhumid belt to the Pacific waters, and protect them by the strong arm of both Federal and State law.

PUSH AND PROGRESS EVERYWHERE.

IN California and all the coast States there seems to be increased push and progress. With the building of three railroads at Stockton, with an average of nine building permits issued per day during the year at Los Angeles, with the completion and operation of the great electric power plant at Sacramento, and the projection of half a



WM. REECE, OF FALLS CITY, NEB.
AUTHOR OF "ATMOSPHERIC IRRIGATION" IN THIS NUMBER.

dozen electrical enterprises deriving power primarily from running streams—with these and many other indications, greater and smaller, the reasons for faith in California are not obscure. But it is the same all along the line of the coast States. California is only forty-five years old as a State and is officially valued at $1,132,712,674. This is $840 for every man, woman and child in the State, or $4,200 for every family.

Several California towns and cities have made progress since last mention in the matter of acquiring city water works. San Diego, through its Council, has decided to offer $500,000 to the San Diego Water Company for its distributing system. Alfred Billing has filed in the Recorder's office at Bakersfield a claim for 35,000 inches of water of Kern river to be used in developing power for the generation of electricity. A claim has been filed to divert water from the Mokelumne river. An ordinance has been adopted by the Board of Trustees of Pomona providing for the construction of waterworks and the acquisition of certain water rights to supply the city of Pomona with water. San Jose is busy with the proposition of the Citizens' Water Company to take water for irrigating and other purposes from the vicinity of the headwaters of the Coyote creek. The municipal ownership of waterworks in Santa Rosa seems to be assured by the purchase of the bonds by Robert Effey, mayor of Santa Cruz.

Creamery companies have been organized at several places. The Western Oil and Gas Company has been incorporated at Salt Lake to carry on the business of boring and sinking wells for petroleum and natural gas, with a capital stock of $1,000,000. The Seattle Power Company has begun work on the plant by which the power of Cedar river is to be transmitted to Seattle and Tacoma at a cost of $1,000,000. The Northwest continues to move in a direction to secure Eastern factories. A wooden spout factory, which will give employment to about 100 men, is now being moved from Minneapolis, where the company has been in business.

UNPROFITABLE FRUIT RAISING.

A VERY thoughtful article by Edward T. Adams on "Co-operation Among Farmers" appears in the November *Forum*. The paper deals almost exclusively with the difficulties which past experience has proved to lie in the way of effective co-operation.

The greatest of these difficulties, according to Mr. Adams, seems to be that in the direction of large affairs, a man of large abilities is required; and such men are not easily found, and when found must always be well paid.

Hitherto, according to Mr. Adams, the farmer and fruit-raiser could not be made to understand the economy in paying the price which such a competent man must always cost; and in the employment of less competent men the result has nearly always been loss and dissatisfaction.

It is quite certain, however, that fruit raising is now a well established industry; and it is also certain that year by year it will assume greater and greater proportions and importance; and it will not for any considerable period be carried on at a loss.

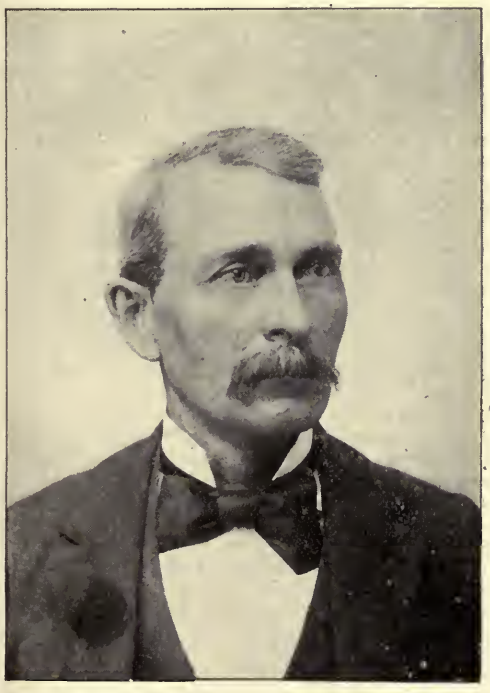
The fruit-raisers have already learned a great many lessons in this expensive school of experience, and it may be that they have still a few lessons to learn, but we have sufficient faith in the average intelligence, and in the force of circumstances to believe that out of it all must soon come some good, solid, working plan of effective co-operation.

There must always be a very considerable margin between the selling price of fruit on a California ranch and the retail price of this same fruit in the big cities of the East; but this difference does not all of it mean loot by the transportation companies and by the commission men.

Without co-operation, the fruit-raiser would be quite at the mercy of these monopolistic birds of prey, who would pick his bones clean. Co-operation is the order of the day and it must be made effective.

NEBRASKA IRRIGATION LAW.

THERE has been much unnecessary alarm as to what will be the effect of the decision recently rendered by the Nebraska State Supreme Court in a suit between a mill owner and an irrigation company, all because the decision has not been generally understood. Instead of being adverse to irrigation interests in the State, it is the very reverse. The ditch in question is referred to in the decision as "a public work." The leaning of the court, though not called upon, or attempting to decide whether or not an irrigation undertaking is "a public undertaking," is most strongly in that direction. It was on this very ground that the Supreme Court sent the plaintiff,



E. G. HUDSON, OF LINCOLN, ILL.
TREASURER NATIONAL IRRIGATION EXECUTIVE COMMITTEE.

Enos Clarke, out of court minus the irrigation by which he had sought to restrain the Cambridge and Arapahoe Irrigating and Improvement Company from using water from above his mill-dam. In view of the great injury or inconvenience that the public might suffer, the Supreme Court refused to allow Clarke his injunction holding that he had been guilty of laches in allowing such a public work to proceed in construction, without raising his hands to interfere or prevent.

George W. Shields, of Omaha, in discussing the decision says: "This case was decided without respect to the validity of the irrigation law. I doubt if anybody in the State, aside from the lawyers who were fighting Clarke's case, believed he had any show for his contention. He was a mill owner, and had for years been using water from the stream. He had acquired a vested right to its use. That was a common law right. When, later, the irrigation company in question stepped in and interfered with that right without making compensation, it took away a right granted to Clarke by the constitution to enjoy his prosperity unmolested. The passage of a statute could not take away this common law right, because it was anterior to the rights conferred upon the irrigation company, and which existed only after the passage of the statute. So, although the irrigation company filed its water lien after the passage of the law, and after Clarke had for years used and exercised his rights, it could not divest him of them. The Supreme Court simply held that a riparian right at common law is a vested right, yet the only remedy it gave Clarke was to sue for damages. He had waited too long to get an injunction, since this was a public work he was attempting to stop the progress of. The outcome of the case, I have no doubt, is regarded by the irrigation company as a victory.

"The further question arises whether or not the irrigation company could not have condemned the vested right of Clarke by the right of eminent domain and bought it. It could, without doubt, if irrigation canals are public improvements. That is the whole question at issue at this time. That is the question we will attempt to settle in the Alfalfa Irrigation District case in order to make our bonds good, and that is the question which will more or less directly be called up for decision in another irrigation case now pending before the Supreme Court, entitled the Paxton & Hirshey Irrigating Company against the Farmers' and Merchants' Irrigating Company. The latter case arises more especially under the 1889 and 1891 law.

"Just the moment that question is decided, the Globe Loan and Trust Company and other financial institutions are willing to buy these irrigation bonds issued by irrigation districts. The Globe Loan and Trust Company, which is a defendant in the Alfalfa district case, has gone into the suit to determine this very issue.

"One can readily see that such a question was not in issue in the Clarke case, because Clarke had rights in existence before the passage of the 1891 law. If the 1895 law abolishes the common law rule that a riparian right is a vested right, that is another question, and affects only those, at the most, whose rights accrue subsequent to the passage of the law. However, I do not really think that the decision is of great importance any way, because there are so few mills in this State depending on a water supply, that there is likely to be little conflict between the mill owners and the irrigating companies. If, as we contend, irrigation is a public improvement, and as we think our Supreme Court will hold, why, then, this matter of damages is a matter capable of adjustment by condemnation proceedings."



I. A. FORT, OF NORTH PLATTE, NEB.
PRESIDENT OF THE NEBRASKA IRRIGATION ASSOCIATION.

GREAT SUCCESS IN COLORADO.

One of the editors of the Manhattan (Kan.) *Homestead* recently visited the San Luis Valley in Colorado. The following is an extract from an interesting account of the trip which appeared in that paper:

"We passed miles and miles of standing grain for the harvest is about two weeks late. Wheat of a style we never saw before. Tall and sturdy and with full heads. Oats stood in the uncut fields fully as high as an ordinary man's head. We proved the height by having one of the workmen step into the standing grain. It was above his head, and an ordinary man could easily get lost from view in the standing oats. Just think of oat straw six feet long, and these bore well-filled heads of oats that weigh out forty pounds to the bushel."

THE WRIGHT LAW.

The Los Angeles *Times* says: "Farmers in this section were much disappointed at learning that the irrigation cases testing the Wright law, which were to have been tried last month by the Supreme Court, have been postponed until January, 1896. It is to be hoped that there will be no unnecessary delay in this matter. It is most important that some decision should be reached. While the matter is unsettled it is impossible to proceed

with many contemplated improvements and a number of horticulturists in this section cannot tell where they stand."

The Fresno *Republican* has the following editorial: "The San Francisco *Call* gives Henry Miller, the well-known land baron, a pretty severe shaking up for his opposition to the Wright irrigation law. The position of the *Call*, that great land monopolists who persistently oppose every effort looking toward a more advanced system of agriculture than is practiced by them are enemies of the State, is well taken. The Wright irrigation law is undoubtedly defective in some respects, but the duty of every citizen who desires the welfare of the State is to assist in remedying those defects rather than to raise up barriers against the success of any form of irrigation under public control. The opposition of Mr. Miller and his class to irrigation under the district system is simply that of any monopolist who holds large interests and desires to retain an exclusive control over them regardless of the effect upon the general welfare."

The hearing of the case testing the Wright law in the United States Supreme Court has been definitely set for the first Monday in January.

ARIZONA.

By competent experts it is estimated that there are 25,000 head of cattle in Salt River valley being fed and fattened for the winter markets East and West.

A company of capitalists are busily engaged in planting 2,000 acres of canaigre on the extensive possessions of Miguel Wormser in the Salt River valley. This new tanning agent is coming to the front as one of the most profitable crops that can be grown in the valley. It grows wild along all the streams, but under cultivation the value and amount of the crop is largely increased. The process of extracting the acid from the roots is almost identical to the process used in making sugar from the sugar beet, which plant the canaigre in a measure resembles.

More than twenty new houses are in course of erection at Phœnix, but still the tide of travel increases and fills them up as fast as they are finished. Merchants and business men generally notice the increase of population and many declare that the town is on the verge of a boom.

It is reported that a good service of local trains will be run from Phœnix over the new M. & P. railroad and the people of Mesa and vicinity are correspondingly jubilant.

The report of Governor Hughes of Arizona to the Secretary of the Interior, says that during the year, Arizona was favored with a high degree of prosperity.

The present population of Arizona is placed at 77,000, being an increase of 7,000 during the year, 90 per cent of the immigrants locating in the districts of Yavapai county and the agricultural section of Maricopa county.

CALIFORNIA.

Of the 38,000,000 acres of arable land in the State of California only 2,500,000 acres are yet under cultivation. The population is now a little over 1,250,000, or one for every two acres of tilled land. With irrigation and improved methods of cultivating the soil, every two acres of the vast area of arable land of the State will easily support one person. When this is the case the population will be 19,000,000. The total valuation of property for 1895 is $1,132,712,674, forty-three millions of which represents railroads.

A new incorporation is the Fort Hill Land & Water Company, of Claremont. Capital stock, $100,000, with $17,750 paid in. The incorporators are C. Hanson, of Los Angeles; Frank S. Mead, Edwin E. Cole and Henry Hanson, of Pomona.

The directors of Turlock irrigation district have fixed the tax rate at $1.62 on each $100 valuation. The rate in Modesto district is $1.78. Letters from Judge Waymire, contractor on the Turlock canal, are to the effect that he is arranging to put in the necessary headgates, etc.

The directors of the Oakdale Irrigation Company will hold a meeting and it is expected that there will be a formal consideration of the proposition to transfer such stock to L. P. Drexel as may be necessary to insure the successful operation of the Oakdale canal by water supplied from the North canal.

The deed to the new Bear Valley Irrigation Company, in consideration of $380,000, has been filed by A. G. Hubbard, of Redlands. It conveys the whole Bear Valley system.

A call has been issued by the directors of Escondido irrigation district for a special election to issue an assessment of $8,000.

L. A. and B. A. Wright and E. B. Knapp have filed water claims upon about 6,000 inches of water on what is known as the Hot Sulphur Springs Tract, near San Jacinto. They give notice of an intention to divert said water, by means of a pipe line, for irrigation purposes.

L. W. Houghton had on exhibition at the Los Angeles fair a sack of English walnuts, which took the highest prize. His ranch is one mile southeast of Downey.

At the Orange Growers' meeting at Riverside, the old eleven directors of the Riverside Fruit Exchange were re-elected, save one, C. H. Low, who was replaced by Hon. H. M. Streeter. The other ten are A. H. Naftzger, M. J. Daniels, D. W. McLeod, T. H. B. Chamblin, S. C. Evans, Jr., George Frost, J. H. Wright, G. W. Garcelon, E. F. Kingman, A. P. Johnson.

An eastern firm has determined to establish an extensive canning establishment at Redlands.

A full car-load of lemons from Riverside was sent to Boston, and the fruit brought $4 to $6.75 per box. Had it been properly graded the price of some of it would have run up to $10 per box.

The meeting of the Fruit Growers' Association at Pasadena re-elected the old board of directors, who organized as follows: President, George F. Keenaghan; vice-president, B. F. Ball; secretary, J. F. Jones.

Mr. Joachin, of North Pasadena, has succeeded in raising a fine hardshell almond, which he calls the "Populist almond." It is said the fruit flourishes in the neighborhood of eucalyptus trees.

The Pacific Coast Oil Company has begun work on their mammoth storage tank at Ventura. The tank, when complete, will be connected with the pipe line leading to Sudden's wharf.

Probably the largest and most promising enterprise in Southern California to-day is the well-matured project of sending power from Kern river to Los Angeles by electric transmission.

A trial is to be made in Monrovia for artesian water.

And now Colton is talking canaigre. Representatives of a Philadelphia syndicate are reported to be negotiating for a factory there.

The Orange County Fruit Exchange unanimously decided that it will stand by the Southern California Fruit Exchange.

Dixie Thompson, of Santa Barbara, estimates that his Ventura ranch's bean crop will bring him $50,000 this year.

Senator White and Congressman McLachlan have promised San Diego that they will work jointly with Congressman Bowers for an appropriation of $150,000 for improvements at the mouth of the harbor.

The trade in California sweet wines is showing a gratifying increase. The total estimated product for this year is 3,000,000 gallons, which is twenty-five per cent more than was marketed last year.

At the Los Angeles Fair R. H. Hewitt showed several plates of the canaigre root, the tuber from which tannic acid is made. The propagating of this tuber, akin to a sweet potato in form, promises to develop into a new industry.

COLORADO.

The Boyd Lake Reservoir Co., of Greeley and Denver, are surveying the site of their proposed reservoir, which is located two and one-half miles north of Loveland. The reservoir when filled will cover 2,500 acres with an available depth of twenty-five feet, and will contain about 30,000 cubic feet. It is intended to store water for ditches below on the Cache la Poudre for late irrigation. J. H. Robinson is the engineer in charge.

At Denver, the Forke Reservoir Drain & Irrigation Company has been formed. Incorporators, Clara Brown Denig, J. L. Fulton and E. M. Jacobson.

The Lolita Land and Irrigation Company has been incorporated, with capital stock of $50,000, to build reservoirs and reclaim land in the Horse Creek Valley. The incorporators are F. T. Webber, F. A. Sabin, C. Bomgardner and John O'Neil, all of La Junta.

An artesian well is being sunk near Holyoke, Colorado.

The press generally pronounce the Festival of Mountain and Plain, held at Denver, a grand success.

The mines at Cripple Creek are turning out gold at the rate of nearly $1,000,000 a month, at a net cost of less than $4 per ounce. This gold sells at the mints for $20.67 per ounce.

The assessed valuation of Colorado is $201,308,969. Thirty-four counties show an increase in their valuation, while twenty-two are the reverse.

KANSAS.

Apple carnival at Leavenworth, and the preparing of the Million Club State Exhibition Train for its departure, were duly celebrated. On the day of the carnival every building and store front in Leavenworth was gorgeously decorated with apples of all sizes and color, and the carnival colors—red, yellow and green—were conspicuous everywhere. There were thousands of visitors in the city, coming from all over Kansas. Business for the time was wholly suspended. A street parade a mile long was a feature of the afternoon, and Governor Morrill, Governor Woodbury of Vermont, United States Senator Baker, Secretary of State W. C. Edwards, Congressman Blue and others made speeches. In the evening the city was brilliantly illuminated and the festivities were continued until a late hour.

The Kansas State Board of Agriculture has completed the census of the State for 1895 and finds the population to be 1,334,668, an increase since 1885 of 66,138.

To the question of alfalfa without irrigation the *Kansas Farmer* says: "In eastern and central Kansas farmers are greatly pleased with it. On some of the bottom lands of the western part of the State good money has been made from alfalfa without irrigation. The writer's observation is, however, that it responds to irrigation with greatly increased yields."

James Adams has just raised a fine crop of peanuts on his farm in the sand hills near Abilene.

This is a busy season among the seedgrowers in Kansas. A drive through the section of the country near Garden City reveals some wonderful sights to the uninitated. Everywhere one sees great piles of cucumbers ready to be threshed out and long rows of water and musk melons, squashes and other vegetables.

It is claimed that the yield of corn in the vicinity of Wakefield was seventy bushels per acre.

Mitchell county is to hold a corn carnival, adjoining counties being invited to participate. The affair at Atchison was a great success.

Topeka is erecting another great grain elevator.

W. H. Snow, son of Chancellor Snow of the State University and Assistant Bugologist, was at Kinsley recently investigating the new potato bug which has settled in that vicinity. Some specimens of the bug and effects of its ravages have been sent to Washington.

Under the latest Kansas game law, water fowl are the only species of game that may be killed, trapped or ensnared lawfully.

MONTANA.

Reports from Great Falls say: "A stampede is being made for the new gold fields on Harley creek, and the hills are teeming with prospectors who have staked out every foot of ground in the vicinity of the first claims and are out with a grand new town christened Johannesberg as a token of the future camp. The rock is of a dull terra cotta color that crushes easily between the fingers and bears gold in large quantities. Johannesberg is in the Belt Mountains and easy of access."

Montana has shipped more than 7,000 cars of cattle this year.

NEBRASKA.

Senator Akers of Nebraska is responsible for the plan to draw water from the Platte river, west of Kearney, and carry it across the counties of Adams, Kearney, Webster, Fillmore and Jefferson, and a part of Clay county. The counties along the line of this irrigation canal are among the best in the State.

Another new ditch, about thirty miles long, from Almeria down the Loup river, and probably later to Ord, will be rapidly built. The organization is the Tschuck Canal Company, with capital stock of $50,000. The incorporators are, George Tschuck, W. E Babcock, O. L. Horr, M. E. Getter, D. A. Gord and H. A. Stewart.

Scott's Bluff is called the banner irrigation county of Nebraska. It has 149 miles of completed canals. and 100,000 acres are now under irrigation. The various cuts are indicated by the following corporations: Castle Rock Irrigation Canal Company, A. J. Baquet, president; Central Ditch Company, Martin Gering, president; Enterprise Ditch Company, M. K. Powers, president; Farmers' Canal Company, W. H. Wright, president; Gering Canal Company, W. S. Peters, president; Gering Irrigation District, Ed. W. Sayre, president; Minatare Canal Company, A. W. Mills, president; Mitchell Canal and Irrigation Company, John R. Stilts, president; Ramshorn Ditch Company, Carroll Nichols, president; Winters Creek Irrigation Company, George Sowerwine, president. Gering is the central city in the county.

The Nebraska State Irrigation Convention holds its session at Sidney on the 17th, 18th, and 19th of this month. A full attendance is assured.

The Gering papers say the proposition made to the stockholders in the big ditch on the south side is as follows: They are to receive for each paid-up share of stock $200, the sale to be conditioned upon the actual building of what is known as the high line canal. Each stockholder is required to subscribe for a forty-acre water-right for each 160 acres he may own, to be paid for at the rate of $10 per acre at the end of ten years, at 7 per cent interest. All water-rights are subject to an annual assessment of $1 per acre.

NEW MEXICO.

One of the largest deals that has ever taken place in the Pecos valley was concluded a few days since, and Tansill farm passed into the possession of John B. Overmeyer, of Chicago, the consideration being $100,000 for the farm, improvements, livestock and crops thereon. Colonel Tansill was one of the original organizers of the Pecos Valley Irrigation Company.

The military reservation at Fort Stanton, N. M., is to be abandoned. The Secretary of the Interior has informed the Secretary of War that it is no longer necessary for protection against the Indians, and its usefulness has become a thing of the past.

The Pecos Valley exhibition train contains a most attractive exhibit of fruits, Egyptian corn, Milo and Kaffir corn, peanuts, big pumpkins, watermelons, honey, corn in stalk, etc., etc. The train was in charge of the Pecos Irrigation and Improvement Company. Pecos Valley will hold a great fair next season.

A number of apple trees in James Scott's orchard, two miles below Aztec on the west side of the Animas river, were so heavily laden with fruit this year that the roots gave way and the trees were ruined.

Improvement work is constantly going on in the Pecos Valley. New irrigation ditches are being excavated, farms are being opened, houses and barns erected, orchards planted, fences built, etc.

Like Kansas, Missouri, and her own favored Pecos Valley, New Mexico proposes to furnish a special train with suitable specimens of her products and to make a traveling exhibit of the same.

A fair-committee is investigating the subject of holding an annual fair at Raton. The enterprise will take in all of northern New Mexico.

The fair at Springer was a complete success.

I. S. Osborne, of the Pecos Valley, says that the Russian sunflower is not a profitable crop to grow, although it is a rich food.

Seldomridge & Pebbles shipped 5,300 sheep from Lamy, New Mexico, to Colorado Springs over the narrow gauge road. They will feed for the mining town markets and expect to put some on the Boston farm near Olney in the Arkansas Valley.

W. E. Tong, of Nebraska, is at Eddy, looking up a site for an extensive creamery.

Referring to the new government Climate and Health Bulletin, Director Hersey of the New Mexico service says: "If the medical profession of the Territory will take up this work and cooperate with the weather bureau, it will prove a golden opportunity to demonstrate to the general public that this is the greatest natural sanitarium of the world."

The protracted litigation over the Tiffany ranch near San Marcial resulted in a decision favorable to A. D. Cook, who will make extensive improvements there.

In the Oklahoma Supreme Court, the decision of Judge Bierer was sustained, in which he decided that all counties had a right to contract indebtedness and issue warrants and bonds from the day of their creation as counties, and not be compelled to wait until an assessment of property was made. This legalizes the contracts issued by the Cherokee Strip counties and cities in the first year of their existence, as well as those of all other new counties and municipalities in the Territory, past and future.

TEXAS.

Surveys are being made for an irrigation system in Baylor and adjoining counties estimated to cost $500,000 to $750,000.

The San Antonio Irrigation Company are purchasing excavating machinery, water-gates, pipes, etc.

The *Texas Stockman* says editorially: "True there has been an abundance of moisture in Texas this year for the production of more than an average crop, but how about next year and the next? The farmer who can turn the water on his land at will is infinitely better off than his neighbor who is wholly dependent upon the whims of the weather clerk. Irrigate."

The State fair at Dallas, assumed the proportions of an exposition. It was visited by hundreds of thousands of people.

The range districts of Texas are better supplied with grass than at any time for several years past, and cattle will go through the winter in good shape. Especially is this true in south and west Texas, where the grass is said to be better than at any time since 1882.

Marlin is to have a $50,000 plant of waterworks, electric lights and irrigation system.

The twelfth annual fair and race-meet of the Guadalupe County Fair Association at Seguin surpassed all previous exhibitions. Guadalupe county is one of the best agricultural and stock raising counties in the state, and is settled with hard working, progressive people.

Concho Valley Fair, at San Angelo, had full exhibits and a large attendance.

One of the largest cattle trades ever made in southern Texas was consummated recently. M. R. Kennedy, of Williamson county, bought 6,000 four

and five-year-old steers from Bennett Bros., of DeWitt county.

A great show was given by the Southwest Texas Fair Association at Victoria. The officers of the association are D. Heaton, president; W. C. Barnes, vice-president; D. H. Reagan, treasurer, and L. N. Hofer, secretary.

The Wool Growers' Association of Bosque county held a big meeting at Meridian. Efforts are being made to reorganize the State Association.

The city of Gainesville has sunk a well for water supply.

New Birmingham is to be revived, and so are the blast furnaces at Llano.

The Water Development Company has engaged a St. Louis engineer to make plans for a waterworks system at Corsicana.

The iron ore beds of east Texas are rapidly coming into prominence.

At the State Irrigation convention at Waco there were present from different sections of the State about 100 representative men. They made arrangements to try to have the next legislature submit a proposition to the people to have the State constitution changed so as to people the State more rapidly from abroad. Under the present constitution the State is prohibited from expending any money for any immigration purposes whatever.

Burnet and Llano counties are shipping huge walnut logs to Houston, from which point they go to Europe and are there converted into furniture, much of which finds its way into this country.

UTAH.

The Bear River Irrigation Canal Company will have 75,000 heads of marketable celery this season, which will be sent to the Chicago market. This company also has carloads of navy beans, cabbage and cauliflower.

Coal of an excellent quality has been discovered near Mt. Pleasant, in a vein eight feet thick.

George H. Eldredge, of the Geological Survey of the United States, is making a reconnoisance of the Uintah and Uncompaghre reservations, investigating their mineral deposits.

WASHINGTON.

One of the latest incorporated irrigation enterprises is the Washington & Idaho Irrigation Company. Capital stock, $250,000. The incorporators are R. E. Clark, C. W. Clark, H. M. Mosely, G. S. Palmer.

As to the wages paid working people in the State of Washington, the Colfax *Gazette* says: "Skilled labor is well remunerated, mechanics wages averaging $3 a day; the wages of clerks and bookkeepers range from $65 to $100 a month. Unskilled labor receives $1.75 to $2 a day. Farm hands receive $25 a month and upwards. Loggers $2.50 a day and upwards. Horses of a good grade are very cheap."

The price of land in Washington varies according to location. The Northern Pacific railroad has much unimproved land which they sell at from $2.50 to $4 an acre. Improved land can be bought for from $8 to $25 an acre, according to location. Easy terms of payment can be obtained. As good land as there is in the county about Colfax, land which will produce forty bushels of wheat to the acre under scientific farming, can be obtained in fairly well improved state for $15 and $18 an acre.

C. J. Struible, of the Kennewick Valley, has just completed the task of setting out 50,000 strawberry plants.

Okanogan ranchers have just cut the third crop of alfalfa, which averaged two tons to the acre.

A quarter of an acre of C. R. Smith's sugar cane at Kennewick yielded him thirty-five gallons of sorghum. This is a most remarkable yield, and would be equivalent to $70 per acre.

Whitman county, driven by the low price of wheat, is getting to be a great hog section, and it is estimated that at least 75,000 hogs and pigs are owned in the county.

At the Spokane fruit fair Whitman county took the first grand prize and Milton got the second.

Speaking of the Snake River valley, the Colfax *Gazette* says: "As an instance of what can be done on these lands, it is stated that there are numerous well authenticated cases of returns of from $1,000 to $1,500 from patches of strawberries not exceeding half an acre in extent."

Much good is looked for as a result of the meeting of the Northwest Fruit Growers' Association at Walla Walla this month, attended by the leading growers of Washington and Oregon. The action of Eastern consignees in taking the fruit shipments of the Northwest and disposing of them at auction to themselves at figures ruinous to the grower, and then jobbing them out at high rates, has called for remedial action. It is understood that an effort will be made to form a close alliance among growers and place capable and honest men in the principal markets to handle the products of the Northwest so as to give the best returns to the producer. The packing of fruit, and other subjects of interest to the grower will be taken up. The State Horticultural Society will meet there at the same time and discuss the subject of pomology in its various bearings.

WYOMING.

The Wyoming Irrigation and Land Company has filed articles of incorporation. Capital, $1,000,000, to operate in Sweetwater county. Trustees are William G. Melville, Louis Kurz, Thos. Knight, Redmond Hughes, Charles E. Cook, Henry D. Barto, of Kansas City, and E. R. Boman, of Leavenworth. C. P. Hill, attorney. Principal place of business, Cheyenne; branch offices located at Kansas City, Denver and Green River.

A new enterprise, contemplating the reclamation of a vast tract of land north of Granger and northwest of Green river, is headed by ex-Governor Marshall of Kansas, now of Denver. Irrigation will be by water from the Green and Sandy rivers.

The Black Fork irrigation project is now being pushed by ex-Congressman John A. McShane, of Nebraska, and Mr. Condon. This tract of land embraces 50,000 acres and lies southwest of Granger, in Uintah and Sweetwater counties.

Converse county has a population of something over 4,000 souls. In 1886 the county contained only a few scattering ranches, and was utilized simply as a stock range. To-day its centers of population are Douglas, Glenrock, Lusk, Manville and Inez, ranking in the order named, all thriving and prosperous towns. Douglas is the county seat.

The Platte Valley Company of Douglas, Wyoming, has 6,000 head of sheep on the trail from Oregon. The company has purchased some fine bucks to put with its flock, including two registered Lincoln rams from Canada, two Hampshires

from Mercer, Pennsylvania, 125 Shropshires and twenty rambouillet rams from Dexter, Michigan.

The appointment of Albert D. Chamberlin as register of the Douglas land office is very generally approved.

B. C. Wheelock, of the lower La Prele, has a handsome harvest of carrots, sugar beets, etc.; Longfellow corn also matured. Samuel Cummings, of Upper La Bonte, raised popcorn as fine as the Eastern product. Some of his cabbages were as large as washtubs.

The storage reservoir of the Wyoming Development company at Wheatland is just completed and water turned in. The reservoir covers 1,200 acres of ground and is fifty feet deep. Its completion insures ample water supply for the Wheatland farms during all seasons.

At the Wyoming creamery Ora Haley is having 125 cows milked, and it is expected that during the winter they will milk 200. A fine product of butter is being now manufactured and with the advancing prices the creamery, it is expected, will pay well.

BOOKS AND MAGAZINES.

The Century for the Coming Year.

The Century Magazine celebrates its quarter-centennial in its November issue with an "Anniversary Number." In honor of the occasion it dons a new dress of type, with new headings, etc., and it appears in a new and artistic cover. Although *The Century* has reached an age that is unusual among American magazines, it continues to show the youthful vigor and enterprise that has always characterized it. The programme that has been arranged for the coming year contains a number of interesting features. Much has already been written concerning Mrs. Humphry Ward's new novel, "Sir George Tressady," which has been secured for its pages. The story describes life in an English country-house, and also touches somewhat upon industrial questions. It will be the leading feature in fiction for the coming twelve months, other and shorter novels being contributed by W. D. Howells, F. Hopkinson Smith, Mary Hallock Foote, and Amelia E. Barr. There will also be contributions from Mark Twain and Rudyard Kipling (the latter furnishing to the Christmas *Century* one of the most powerful stories he has ever written); a series of articles on the great naval engagements of Nelson, by Captain Alfred T. Mahan, author of "Influence of Sea Power upon History"; three brilliant articles on Rome, contributed by Marion Crawford, and superbly illustrated by Castaigne, who made the famous World's Fair pictures in *The Century*; a series of articles by George Kennan, author of "Siberia and the Exile System," on the Mountains and the Mountaineers of the Eastern Caucasus; articles by Henry M. Stanley and the late E. J. Glave, on Africa; a series of papers on "The Administration of the Cities of the United States," by Dr. Albert Shaw.

Prof. Sloane's "Life of Napoleon," with its wealth of illustration, will reach its most interesting part,—the rise of the conqueror to the height of his power, and his final overthrow and exile. In order that new subscribers may obtain the whole of this monumental work, the publishers have made a rate of $5.00, for which one can have a year's subscription from November, '95, and all of the numbers for the past twelve months, from the beginnig of Prof. Sloane's history.

McClure's Magazine appears this month with a photograph of Abraham Lincoln on the cover. With this number begins the publication of a "Life of Lincoln", which is well illustrated and more than fairly well written.

The Review of Reviews occupies a field all by itself, and gives us quite as much interesting information concerning the recent political and other affairs of the various nations of the earth, as the average man has time to read.

The Cosmopolitan is always worth more than the very moderate price asked for it. The two most notable articles this month are: "The German Emperor and Constitutional Liberty," by Poultney Bigelow; and the story of the naval disaster at Samoa, six years ago.

The Forum is filled full of food for thought. We have elsewhere commented upon a very notable article on "Co-operation Among Farmers." Besides this there is an article by O. D. Ashley, on "The General Railroad Situation"; and one by Professor Leslie Ward, on "Plutocracy and Paternalism"; which are worthy of note.

Lippincott's for November is quite up to the standard of excellence which this publication has always maintained. The most noticeable article is a tale of Washington life; "In Sight of the Goddess," by Harriet Riddle Davis.

Scribner's Magazine for the month is full of good reading. "A History of the Last Quarter of a Century in the United States," by E. Benjamin Andrews, President of Brown University, being especially worthy of note.

Munsey's for November is a delightfully artistic number. The photographs of a large number of European feminine notables are especially good. They include the Queen of Portugal; the crown Princess of Sweden; the Queen of Denmark, her daughter and grand-daughter, the Princess of Wales and the Duchess of Fife; and also many other well known ladies of high degree.

Monthly Illustrator "Edison on Inventions," is the title of an interesting article by Rufus R. Wilson, which appears in *The Monthly Illustrator and Home and Country* for November. The article is based on an interview with Mr. Edison. No inventor, or indeed any one connected with manufactures of which invention is the basis or an integral part, but will feel an interest in what the great "Wizard of Menlo Park" has to say on the subject. Mr. Edison is very severe in his criticism of the patent laws and the present practice in our courts, which works so seriously against inventors and in favor of patent thieves, whom he properly designates as *pirates*.

Contracts and Specifications.

We have received a copy of a recent publication issued by the Engineering News Publishing Co., of New York, entitled, "Engineering Contracts and Specifications," by J. B. Johnson, C. E. It is a book of rather more than four hundred pages, and although it is necessarily full of technical terms and phrases, yet the style and arrangement is so clear and lucid, that it may be studied easily and profitably by any intelligent man who is in any way interested in such subjects. It will be found especially useful to irrigators. It contains a brief synopsis of the law of contracts, and illustrative examples of the general technical clauses of the various kinds of engineering specifications.

THE EDITOR'S DRAWER.

KANSAS proposes to increase her population by a million, and there can be no doubt that she will be successful. Press and people are all working enthusiastically in the common cause, the clergy included. Various plans are being vigorously pushed to induce immigration to the State, and if the advantages to settlers there are not generally known throughout this country and Europe, it cannot be said to be the fault of the newspapers, the various committees, the State officers and congressmen, and the railroads. A most enterprising feature of the whole movement is the Million Club's exhibition train, which is a traveling advertisement all over the United States. It consists of six cars, bearing the choicest fruits, vegetables, and products of the State, every county being represented in the exhibits. Mayor Hook of Leavenworth was in charge, and Governor Morrill and many leading citizens of the commonwealth accompanied the train as far as Kansas City. One of the cars is fitted up as a handsome reception room, and levees are given at every important town and city stopped at, no opportunity being lost to talk up the merits of Kansas while displaying her almost unlimited resources.

YAKIMA is well written up in a handsome pamphlet entitled "Irrigation, With an Example of Its Application in the Arid Regions of Western America," issued as a reprint from the Journal of the Franklin Institute, Philadelphia. A. B. Wyckoff is the author.

AT the annual meeting of the Texas State Wool Growers' Association at San Angelo, resolutions were adopted, unanimously, declaring for a protective tariff on wool. The president's address was devoted almost wholly to a plea for a protective tariff.

TIME was, and not so long ago, either, when life and property were nowhere safe in Texas, but that time has gone by. Texas is emancipated, no better proof of which can be offered than the manner in which she squelched the prize fighters. No wonder that settlers are flocking into the new Texas to develop her rich resources.

THE Nebraska State Irrigation Association meets at Sidney on the 17th for a three-days session. The recent decision of the State Supreme Court in regard to mill dam rights will be considered in all its bearings. Full delegations are expected.

AS TO the future of the hog crop, *Western Swineherd* says: "It would seem that prices in the pork market are at the bottom. The cholera is decimating herds over a great extent of territory, and from the infected regions (mostly Illinois and Iowa) everything marketable is being sent out and no attempt made to build up reduced herds. This cannot but be followed by a shortage of hogs six and twelve months hence."

IT is suggested that hogs do not have cholera when pastured on clover. Another correspondent says: "Hogs that are fed raw onions will not have the cholera, and children that eat raw onions will not have the diphtheria.

A SUMMARY of Department of Agriculture estimates gives the acreage and production in the United States for 1895 as of wheat 33,944,850 acres and 424,231,000 bushels, and of corn 81,990,800 acres and 2,161,357,000 bushels. In 1894 there were 1,212,770,052 bushels of corn.

FOR the first nine months of 1895 the imports of the United States exceeded those of the same months in 1894 by $97,480,000. The imports this year exceeded the exports by $43,000,000. We have thus far exported less gold than last year, but we have exported $100,000,000 in bonds.

CORN, and its future, is discussed in an exhaustive paper by C. Wood Davis, of Peotone, Kan. In his opinion prices are not likely to advance either very rapidly or to a higher level. Only a few years ago cottonseed was a waste product of the Southern plantation, but it is even now an important factor in the industrial problem. Mr. Davis shows that it is supplanting the product of some 4,000,000 acres of corn.

BREADSTUFFS, according to R. G. Dun & Co., declined over 20 per cent. from the end of May to the end of August, and are still down; prices of meat, 10 per cent; dairy products, fruits and vegetables, 23 per cent, and other food, including sugar, tea and coffee, liquors, spices and fish, only 2 per cent. All clothing rose over 10 per cent, including boots and shoes, while iron and steel products rose about 32 per cent.

MONTANA people do not look with favor on the sale of the great Anaconda mining and smelting properties there to the Rothschilds. The latter seem desirous of controlling the copper market of the world, and if they saw fit to shut down the Anaconda mines, 10,000 men would be thrown out of employment in Butte and Anaconda.

THE Northwestern immigration convention, just held at St. Paul, has proven suggestive, and a like gathering for the far Western States is urged as preliminary to an active immigration campaign.

GOVERNOR HUGHES, of Arizona, is urging upon Congress an amendment of the Carey Arid Land bill so that the Territories shall be included in its provisions.

THE Texas State Irrigation Convention was largely attended and the proceedings and utterances indicate a pushing and progressive people, who are determined to develop every resource of their lands.

THE folly of urging the sudden extensive cultivation of any one crop by a considerable number of people, is shown by the surplus of potatoes this season. This was done last spring by certain farmers' organizations. These farmers will doubtless diversify their crops next season.

TOPICS OF THE TIME.

Now for Farmers' Legislation. The arid and semi-arid regions of Western America, as well as the agriculturists of the whole country, are to be congratulated on the results of the recent election. Congress is made up of farmers and the friends of farmers and of progress and development. The same is true of the State legislatures, and now is the time for legislation in the interest of development and improvement. Thorough organization by county or district is the first step necessary, and then needed legislation for relief or aid should be debated and well considered, and when presented for action it should be shown that there is a unit of feeling on the subject. Strong backing—a compact organization of voters—will push any really meritorious and necessary measure through. Legislation is absolutely needed—imperatively demanded—in the arid States and Territories, and the legislatures and Congress will, doubtless, come to the rescue if measures are properly formulated and presented. A liberal appropriation should be made by Congress to continue the irrigation survey, and the dividing of arid America into natural irrigation districts should be done by Federal and State law. The question as to the control of the waters of irrigation districts, which is most important of all, must be settled once and forever. Irrigation is becoming general and there must be some settled law in all the States of the Union. The great drought of the past season will prompt more or less immediate irrigation in sections of many of the Central, Eastern and Southern States.

That Congress will have to listen to the wants of the agricultural classes generally there can be no doubt. The National Grange and the great conference on money and tariff, at Worcester, have put themselves on record, and the National Wool-Growers' Association is now in session almost next door to the Capitol in Washington. It is stated as likely that Congress will attempt to make the Inter-State Commerce Law of some utility at the present session. The farmers of the country also ask for free mail delivery and a postal currency, and they want a thorough system of storm signals, by kites or colored balloons, held captive by light cables. The settlement of land titles in the Western States and Territories is a matter that demands immediate attention.

Irrigation Becoming General. "What the South needs is irrigation," says H. A. Temple, and he writes a long letter to the *Practical Farmer*, of Philadelphia, from Bostic, N. C., advocating it. He complains of the long drought they had in North Carolina the past season, and says he was given to understand that there was no droughts in the South. The *Practical Farmer*, in its lengthy comments on the letter, repeatedly says that "irrigation is not necessary," but the real situation comes out in the concluding paragraph of the editorial:

"What we do need worse than any artificial irrigation on our hills is the deep plowing of the red clay, and the deeper subsoiling, in connection with *terrace banks on the contour lines of the hills, with deep ditches along their upper sides* filled with the surface rocks that now cumber the upper soil, so that the rainfall may not at once run away, but *be allowed to soak into the soil.* And when we have these we want more peas and more clover to fill the soil with moisture-retaining humus, and to increase its fertility. On bottom lands, cultivated in market garden crops, *irrigation would locally be a very desirable thing.*"

The italics are ours, but the words are those of the editor of the *Practical Farmer*. By the beard of the prophet, he is a pretty sound irrigationist without knowing it himself!

But, taken all in all, the soil in that portion of North Carolina does not seem to be what it might; and, wonderful enough, it is conceded that there are droughts—that dry spells in the summer months are not wholly confined to the East, North and West.

It takes time for any great innovation to become universal, but that irrigation is making headway is evident from the announcements of experiments the past season in various Southern States, in the East and through the central States. The agricultural papers of the whole country are discussing it, and the great dailies of New York City are just now publishing detailed accounts of the wonderful crops raised on small irrigated farms almost in their midst, on Long Island.

The droughts of the past season will go far, also, toward making many more converts to irrigation. In sections of Indiana, Ohio, Pennsylvania, Kentucky and West Virginia the crops not only failed but there was actual suffering among the people. In some cases stock died for the want of water. In sections of Missouri there were special services in the churches and special days of prayer for rain. Their bitter experience will point the way to these farmers in the future. It was a dry season in the far Western States and Territories, but the farmers there had made provision by irrigation, and their numerous crops came through in safety.

The fact is that the people of all sections in the

United States are finally coming to realize that there is no sure thing on crops without irrigation —that, with this improved mode of farming, they take no chances. This being true, it will be adopted here and there throughout the country until gradually this safe means will become general. The great success of farming on former arid lands in the Western States by irrigation is educating the farmers and the people of the nation.

Populating Western America. It is evident that the people and the State officials of the Western States generally have come to realize that the best efforts of their live and enterprising home newspapers must not be depended upon as the sole means of directing immigration their way. Settlers are coming in, but, considering the increased and immense immigration to the United States the past year from the Old World, the farm settlers have not come West in sufficient numbers, and all because the merits of these Western States are not properly made known at the landing places of these pilgrims to the New World. Besides following the example of Kansas, and sending exhibits of their crops and resources through the whole country every now and then on special trains, it is now proposed to have special State or Territorial agents in each of the principal cities to which European immigrants are ticketed, who shall have offices provided with maps and charts, exhibits, etc., and who, provided with good credentials so that people can trust them, shall duly advertise and make known the advantages of their sections to the new homeseekers. In a word, it is proposed to bring this business of populating Western America down to business methods, and this is as it should be.

If there were no foreign immigrants at all, farmers are constantly changing location, being either dissatisfied or desiring to enlarge their operations, or to more diversify their operations, and these are to be secured. It is apparent on every hand, and undeniable, that there is great dissatisfaction among the farmers of the great Central States, and, while many of them will irrigate and diversify their industry where they are, many more are looking out for new locations where they can make a living without working such large areas of territory. With their present single one or two kinds of crops a year, if they mature safely, there is in the aggregate an over supply and the prices realized do not pay, and if there is a drought there are no crops and no pay. It is a non-paying feast or an outright famine with them. Great inducements are held out to these people to go South, but, considering the health of themselves and their unacclimated families, they are hesitating.

Established offices in the principal eastern seaport cities, and colonization agents there and through the central cities of the continent will be found to make big returns, and prove the proper means of rapidly populating Western America.



THE PUBLISHERS' DEPARTMENT.

FOUR NEW TURBINES FOR NIAGARA.

The Niagara Falls Hydraulic Power and Manufacturing Company have recently contracted with James Leffel & Co., of Springfield, Ohio, for four of their Improved Double Discharge Horizontal Shaft Water Wheels, to be of eight thousand (8,000) horse-power capacity, under a maximum head pressure of 218 feet, which is far the highest head under which turbines of large capacity have ever been applied in this country or elsewhere. These wheels will drive eight electrical generators, which will be connected direct to the horizontal turbine shafts without gears or bolting; the wheels and generators all running in vertical planes. This is the second large order for turbines built by James Leffel & Co. for Niagara Falls; there being already several of this make of wheel, each of 1,200 horse-power, in daily operation in the Cliff Paper Company Mills, located at the cliffs, near the tunnel. This water wheel company is also building four of their Cascade wheels for one company, to be operated under 730 feet head; part of the power to be electrically transmitted, by connecting the wheel shaft directly to the generators. The Cascade wheel is, however, essentially and entirely different in construction and operation from the turbine, being in principle an impulse and reaction wheel. This Cascade wheel plant will have an aggregate capacity of six hundred (600) horse-power. If you mention THE IRRIGATION AGE when you write, a complete catalogue will be sent free upon application to Jas. Leffel & Co., Springfield, Ohio.

A LARGE ELECTRIC PLANT.

The installation of the electric transmission plant made by the Portland General Electric Company, which owns the entire water power of the falls on the Willamette river, at Oregon City, twelve miles above Portland, estimated at 50,000 H. P., was recently completed. Part of the power has already been utilized by numerous factories and mills erected near by, and in addition to these an electric station, erected some years ago, has supplied current for lighting the streets and dwellings of Portland, and for operating an electric street railway between Oregon and Milwaukee, seven miles away.

The water is taken from the canal, led through an extensive hydraulic installation and discharged into the river below on the other side. The water-wheel plant is from the works of the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, and consists at the present time of three units, each consisting of a pair of vertical cylinder gate improved Victor turbine wheels, forty-two inches and sixty inches in diameter respectively. The smaller wheel runs at a speed of 200 revolutions per minute, and the larger at 100 revolutions per minute. Both turbines are set at the same level, and each carries a pulley; that of the sixty-inch wheel being fixed to the generator shaft. When the large wheel is in operation the two pulleys are belted together, the smaller wheel is disconnected, and the large wheel drives the generator at a uniform speed of 200 revolutions. When the smaller turbine is operated alone the belt lies upon a shelf surrounding the pulleys.

The water is admitted to the penstocks from the upper canal by means of a head gate operated from a platform on the canal side of the station. Each penstock is ten feet in diameter, and is constructed of riveted steel plates. Each wheel has its own flume, the water passing first through the large flume of the larger wheel to the flume of the smaller wheel, whence it passes through a tube into the tail race. In addition to this turbine equipment, an auxiliary power equipment has been furnished, consisting of a set of pumps, including a hydraulic pump for supplying oil to the thrust-bearing cylinders, and a duplex water pump to circulate the water in the cylinder water-jackets. They are operated by two fifteen-inch horizontal turbines inclosed in the same flume.

The complete power plant will consist of twenty three-phase generators and two direct current generators, acting as exciters. The total capacity of the station, therefore, will be 12,800 horse-power, divided into twenty units, each one independent of the other.

This plant when finished will be one of the largest long-distance transmission plants in the world. Its satisfactory operation so far shows admirably, not only the effectiveness of the three-phase transmission system for general service, but also its feasibility.

A PREMIUM IRRIGATION ENGINE.

The Finney County Fair & Irrigation Convention held at Garden City, Kan., October 2, brought out some very interesting irrigation machinery, principally of which the Witte gasoline engine, which was awarded the first premium, was most notable. This ten-horse power engine which was one of their latest improved, run ten hours elevating 2,000 gallons of water or the enormous amount of 1,200,000 gallons, elevated to a distance of twelve feet high and thrown horizontally eight feet at an entire expense of only seven gallons of gasoline; the engine only arrived on the grounds the day before the fair, it was immediately set up and for six consecutive days it kept a small river flowing. The Witte Company also had attached thereto another pump which any farmer could make, it was simply their usual walking beam and pumping jack with a pump made out of a regular oil barrel, running forty strokes per minute, but at every stroke discharging something like thirty gallons of water. The company have spent considerable time and energy in perfecting irrigation machinery, and are now prepared to furnish an outfit, either mounted or stationary, and guarantee results. One of their latest plants was recently installed at Ellis, Kansas, another at Wakeeney, Kansas. Send for a complete catalogue to the Witte Gas Engine Company, Kansas City and mention THE IRRIGATION AGE for a special discount.

A STUDY IN ADVERTISING.

THE curiosities of advertising make an interesting study. The most curious thing about it is that many—the great majority—of those who spend money on it, and are supposed to be the people most deeply interested, do not make a study of it at all. They simply "follow the leader." One dealer—we will say, for instance, in farming machinery—sees the advertisement of a competitor in a trade paper, and he puts his "ad" in, and so on until this paper is full of the ads of dealers in the same line. Pages and pages are filled with them. These business houses and manufactories do not expect to get trade from each other—they are rabid competitors. Now, this paper circulates—where? Right around among these competitors. The proprietors and managers see the display made by their competitor, then look over their own "ad" complacently and then lay back and wait for business. Now, the best that can be hoped for in this mode of advertising is "a standing in the trade." They don't even get that, and they don't get to the buyer at all. Most of these people are good business men in other respects but they fail to pay the same attention to their advertising that they do to other things. Still they wonder how a few of their number, even new concerns, get to the front. It is because these few, while also having a place in the trade paper, go further and put their advertisements in papers which go directly to the consumers, or the users. To learn the secret of success in this matter it is only necessary to watch the course of the patent medicine men. They advertise in the dailies, weeklies and monthlies which are read by the consumers. The latter ask for their wares in the stores, and the stores—"the trade"—then hustle in their orders to the makers. Manufacturers, agents and dealers who want to sell machinery, merchandise or anything else to farmers and stockraisers and country storekeepers must advertise in the papers those classes read.

ADVERTISERS AND PUBLISHERS BANQUET.

Nearly 100 agricultural advertisers and publishers of agricultural newspapers were the guests of the Frank B. White Company at a dinner, in the banquet hall of the Auditorium, on November 14. Elmer E. Critchfield, toastmaster of the evening, introduced Frank B. White, who, as host, gave greeting to his guests. In behalf of the advertisers, the response came from Roy Shuman, while Gen. C. H. Howard spoke for the publishers.

John M. Montgomery, Superintendent of second-class mails, made the statement that as much as seventy tons of bulk mail went through the Chicago postoffice daily. Mr. Montgomery invited those present to visit the postoffice to see how the mail is handled.

Other speeches were made by W. J. Adam, the manufacturer of woven wire fencing; P. M. Sharples, of the Cream Separator Company, and others.

Last Saturday night a plowman's wife was sitting by the fireside reading the *Weekly News*. "Losh me, John," she exclaimed to her husband, "that Hoose o' Commons maun be an awfu' wicked place. I see that they're to hae twa days hard swearin' afore they begin business."—*Dundee News*.

W. W. MONTAGUE & CO.

MANUFACTURERS OF ALL SIZES

SHEET IRON & STEEL PIPE

IRON PIPE

FOR

Irrigating, Mining, Power Plants, Artesian Wells, Water Works, Town and Farm Supply.

SINGLE AND DOUBLE RIVETED.

WATER PIPE

Made in Sections of any Length Desired 12 to 28 Feet.

The Cut on the left shows a section of Five joints of pipe.

DOUBLE RIVETED IN LATERAL SEAMS.

Particular attention is given to Coating Pipe with our *"EUREKA"* Composition, a Special Mixture containing *No Coal Tar*. Iron Coated with this Composition is Rust-Proof and Rendered Impervious to the Alkalies of the Earth, is Practically Indestructible.

Iron Cut, Punched and formed for Making Pipe on the Ground where required.

309-317 Market St., San Francisco, Cal

THE....

ROCK ISLAND PLOW COMPANY

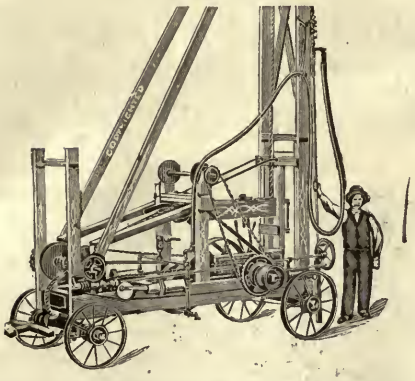
ROCK ISLAND ILLINOIS

Manufactures a very extensive and excellent line of Agricultural Implements.

SEND FOR CATALOGUE AND PRICES....

MENTION THE IRRIGATION AGE.

WELL DRILLS.



Above cut represents a Mounted Elliptical Well Drilling and Prospecting Machine, manufactured by the American Well Works, Aurora, Ill., suitable for 1,000 foot work, or less; can be operated by independent steam, gasoline or horse power, or power and machine can be mounted on same trucks; will handle equally as successfully and rapidly, the hydraulic, jetting, rotary, cable or pole drilling tools, making it one of the best all purpose drilling machines manufactured.

Every owner of a traction engine should have one of these machines, with which he can make a larger per cent of profit for capital invested than in any other way.

The manufacturers would like to correspond with any parties who wish to purchase a really practical machine. A catalogue will be sent postage paid upon application, provided you mention THE IRRIGATION AGE.

Old Farmer (tending threshing machine, to applicant for a job)—Ever done any thrashing?

Applicant (modestly)—Well, some; I am the father of seventeen children, sir.

CALIFORNIA EXCURSIONS.

Leave Chicago via the Burlington Route (C. B. & Q. R. R.) every Wednesday at 6:35 p. m. Route via Denver, Denver & Rio Grande Ry. and Rio Grande Western Ry. (the scenic line) and Salt Lake City. These excursions are accompanied by an experienced agent of the Burlington Route, thoroughly familiar with California. The latest model of Pullman tourist sleeping cars are used. They are fitted with every comfort: Carpets, upholstered seats, mattresses, pillows, bed linen, toilet rooms, etc. They lack only some of the expensive finish of the Pullman's run on the limited express trains, while the cost per berth is about only one-third. Ask your nearest ticket agent for particulars and descriptive folders, or write to T. A. Grady, Manager Burlington Route Excursion Bureau, 211 Clark street, Chicago, Ill.

"Some men," said Farmer Corntassel, "is too well posted. Larnin' is a fine thing, but it's a misfit, sometimes."

"What's the matter?" inquired his wife.

"Thet new hired man hez so much ter say 'bout the silver question thet he stan's roun' an' lets the hay git rained on."—*Washington Star.*



MY HUSBAND Can't see how you do it.

$60 Kenwood Machine for - $23.00
$50 Arlington Machine for - $19.50
Standard Singers - $8.00, $11.00
$15.00, and 27 other styles. All attachments FREE. We pay freight ship anywhere on 30 days free trial, in any home without asking one cent in advance. Buy from factory. Save agents large profits. Over 100,000 in use. Catalogue and testimonials Free. Write at once. Address (in full), CASH BUYERS' UNION,
158-164 West Van Buren St., B 120, Chicago, Ill.



INCUBATORS
We Warrant
The Reliable

To Hatch 80 per cent. SELF REGULATING Durable, Correct in Principle. Leader at World's Fair. 6cts. in stamps for new 112 page Poultry Guide and Catalogue. POULTRY FOR PROFIT made plain. Bed-Rock Information.
Reliable Incubator and Brooder Co., Quincy, Ill.

THE KEYSTONE DEHORNER



Cuts clean on all sides—does not crush. The most humane, rapid and durable knife made, fully warranted. Highest World's Fair Award. Descriptive Circulars Free.
A. C. BROSIUS, Cochranville, Pa.



BERKSHIRE, Chester White, Jersey Red & Poland China PIGS. Jersey, Guernsey & Holstein Cattle. Thoroughbred Sheep, Fancy Poultry, Hunting and House Dogs. Catalogue.
S. W. SMITH, Cochranville, Chester Co., Pa.

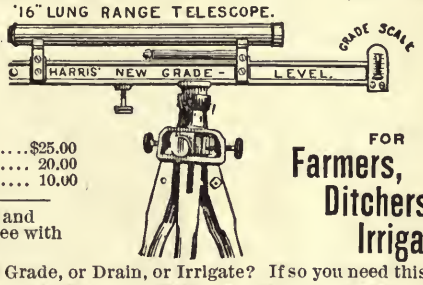
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KEEP YOUR ON THE **LE GRAND POULTRY RANCH**
OF WEST RIVERSIDE, CALIFORNIA.
THEY BREED THE FINEST EGG PRODUCING STRAIN OF
HAVE NO EQUAL **S. C. WHITE LEGHORNS** HAVE NO EQUAL
IN U. S. AND ON FINEST EQUIPPED RANCH IN WEST.
BEAUTIFUL ILLUSTRATED CATALOGUE READY JAN. 1.

NOTICE! EVERY SUBSCRIBER OF THIS PAPER SEND YOUR NAME & ADDRESS ON POSTAL CARD AT ONCE AND WE WILL SEND YOU SOMETHING USEFUL BY DECEMBER 1ST. YOU CAN'T AFFORD TO PASS THIS BY.

"16" LUNG RANGE TELESCOPE.



No. 1.....$25.00
No. 2..... 20.00
No. 3..... 10.00

Target and Rod Free with Each.

FOR **Farmers, Ditchers, Irrigators.**

Do you Grade, or Drain, or Irrigate? If so you need this Level.
MOST SIMPLE, DURABLE, ACCURATE, THE BEST.
Recommended by hundreds who have used it, and some of whom you doubtless know. Their names and addresses, with full descriptive price list and illustrated catalogue sent free on application to parties who mention this paper. Address
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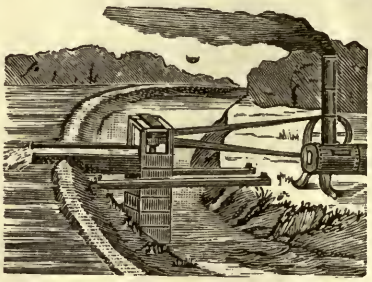
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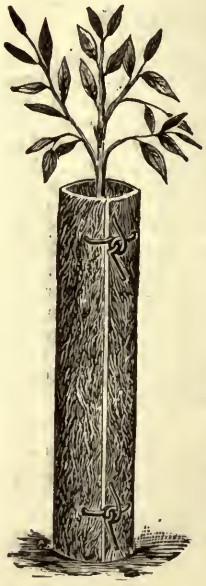
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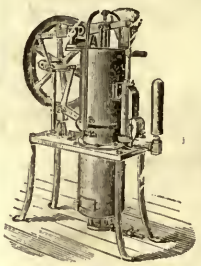


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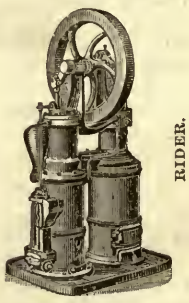
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